

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR.

THE
MINERAL WEALTH
OF
BRITISH COLUMBIA.

WITH AN ANNOTATED LIST OF LOCALITIES OF MINERALS
OF ECONOMIC VALUE.

BY
GEORGE M. DAWSON, D.S., F.G.S.,
Associate Royal School of Mines.



PUBLISHED BY AUTHORITY OF PARLIAMENT.

MONTREAL:
DAWSON BROTHERS.
1889.

To I

Sm
veys
and I
lished
repre
logic
curre
impo
resou
now
provi
ject,
respe
ized f
licati
reaso
write
large
perso
Other
Richa
been
has b

Or

TO DR. ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S.

Director of the Geological and Natural History Survey of Canada.

SIR,—In 1877, I prepared, in connexion with the Government Surveys for the Canadian Pacific Railway, a general note on the Mines, and Minerals of Economic Value of British Columbia, which was published in the Railway Survey Report for that year, and was afterwards reprinted, with some additions, in the Report of Progress of the Geological Survey for 1877-78. Since that time great changes have occurred in respect to the aspects of mining in British Columbia, and important additions have been made to our knowledge of its mineral resources and geology. In view of these, and the increasing interest now manifested in the development of the natural resources of the province and the numerous enquiries constantly received on that subject, it appeared to be desirable to place the available information respecting its mineral wealth in the hands of the public in a summarized form. With this object in view I began the revision of the publication first referred to, but soon found that in order to obtain a reasonably satisfactory result, it would be necessary practically to rewrite the whole. The work has, in consequence, assumed proportions larger than were at first contemplated. I have had an opportunity of personally examining most of the important localities here described. Other places have been examined by yourself, by the late Mr. James Richardson and by Mr. Amos Bowman. For a few which have not been visited by any member of the staff of the Survey, information has been drawn from other trustworthy sources.

I have the honor to be, Sir,

Your obedient servant,

GEORGE M. DAWSON.

OTTAWA, March 1, 1889.

NOTE.—The ton referred to throughout this report is the ton of 2000 lbs., unless otherwise stated.

The
intenc
wealth
a gene
and to
the fi
featur
they
design
nient
him.
consid
vance
the Pr
to be
ploita
object
other
proble
The
necess
than t
import
call fo
short t
be rele
In c
sion to

THE
MINERAL WEALTH
OF
BRITISH COLUMBIA.

By GEORGE M. DAWSON, D.S., F.G.S.

The object of this publication is two fold. It is, in the first place, intended to serve, in some measure, as an exponent of the mineral wealth of the Province to which it refers, to provide an answer of a general kind to the enquiries now so frequently made on this subject, and to collect for this purpose in a convenient form brief summaries of the facts contained in the several official reports on the geological features of the Province, with specific references to the pages in which they are treated of at greater length. In the second place, it is designed to place in the hands of the 'prospector' or miner a convenient synopsis of facts, with a list of localities likely to be of interest to him. In the endeavour to carry out this second purpose, it has been considered advisable to add notes on such general principles, and to advance such suggestions, as from my study of the geological features of the Province, (dating from 1874) appear to be of importance, and likely to be of service at the present time in guiding the search for or exploitation of its metalliferous deposits. In further pursuance of this object, some facts resulting from late practice and investigations in other mining regions are alluded to, and their application to the problems of development in British Columbia is briefly noted.

The treatment of the various subjects included in this publication is necessarily more or less unequal, and no one can be more fully alive than the writer to its incompleteness in many respects. While the important developments now in progress in the Province appear to call for the present publication, it is to be anticipated, that within a short time anything that can now be said regarding vein-mining will be relegated to a position of merely historical interest.

In connexion with the preparation of these notes, I have had occasion to apply to several gentlemen for information, which has been

Object and
plan of report.

Acknowledgements.

readily and cordially supplied. I am under obligations particularly to Messrs. G. M. Sproat and A. W. Vowell, Gold Commissioners for Kootanie District; to Mr. G. B. Wright, and for some special notes to Mr. R. D. Atkin, J. W. McKay, J. F. Allison, S. Robins and Hon. R. Dunsmuir. Much assistance has also been received from Mr. Amos Bowman, and in the matter of assays and analyses from Mr. G. C. Hoffmann.

GENERAL PHYSICAL FEATURES.

Area and
position of
British
Columbia.

The Province of British Columbia, with an area of 390,344 square miles, includes a length of over 800 miles of the Cordillera belt of the West Coast, a region of mountains and of geological disturbance, which in this part of its extent has, between the Pacific Ocean and the elevated western margin of the Great Plains, a breadth averaging about 400 miles. This great mountain region extends north-westward and south-eastward, and constitutes the effective cause which has produced the similar trend of the Pacific coast between the same parallels of latitude. It represents the northern continuation of the most important metalliferous area of the United States, essentially repeating its main orographic features, though presenting also some notable differences of a general kind as well as many local peculiarities.

The Cordillera
belt.

The Cordillera belt, in British Columbia, may be described as comprising four great mountain systems or principal axes of uplift and geological disturbance, which are, in the main, nearly parallel to each other and to the coast,—the Rocky, the Gold, the Coast and the Vancouver ranges.

The Rocky
Mountains.

The Rocky Mountain Range proper, is the furthest inland, and has an average breadth, in its southern part, of about sixty miles, but is decreased near the Peace River to forty miles or less, and apparently loses its importance and regularity locally where cut through by the Liard, though recovering both still further to the north-westward. Near the 49th parallel, several summits occur in this range which exceed 10,000 feet in height, but northward, few attain this elevation till the head-waters of the Bow River are reached. About the sources of the North Saskatchewan and Athabasca, the range appears to culminate, and Mounts Brown and Murchison occur, with reputed heights of 16,000 to 13,500 feet respectively. Near the Peace, few summits exceed 6000 feet, so far as known. Though more or less extensive snow-fields occur in many places, true glaciers are found only about the heads of the Bow, North Saskatchewan and Athabasca. Some of the valleys penetrating this range on the east,

are lightly timbered or in part prairie-like in character, but, as a rule, the mountains are thickly wooded wherever sufficient soil exists for the support of trees, and owing to the greater rain-fall on the western slopes of the range, the forests are there often very dense.

Crystalline schists and granite, are scarcely known in any part of the Rocky Mountains between the 49th and 60th parallels, the ranges being built up chiefly of a great series of Palæozoic rocks, extending from the Cambrian to the Carboniferous, with a total thickness of more than 28,000 feet in the Bow River region. There are also, however, more or less isolated basins of rocks of Cretaceous age, which rocks were evidently at one time continuous with those of the same age in the eastern foot-hills and Great Plains. In these basins, beds of bituminous coal and of anthracite are found. Deposits of copper-ores and of galena are so far the most important metalliferous minerals discovered in association with the older rocks of this mountain system.

The south-western side of the Rocky Mountain Range, is defined by a very remarkable, straight and wide valley, which can be traced uninterruptedly from the 49th parallel to the head-waters of the Peace,—a distance of 700 miles or more. This valley is occupied by the upper portions of several of the largest rivers, including the Kootanie, Columbia, Fraser, Parsnip and Finlay. Gold-placers have been found and worked at a number of points along this valley, and important discoveries of various ores are now being made in its vicinity near the Upper Columbia and Upper Kootanie. It is naturally adapted to become a main line of communication between the southern and northern portions of the Province, near its eastern boundary.

The next mountain system to the south-west of the Rocky Mountains, is referred to under the general name of the Gold Range, though really a complex and somewhat irregular mountainous belt, which includes several more or less distinct and partly overlapping ranges. The Purcell, Selkirk and Columbia* ranges constitute its southern part, while to the north it is represented by the Cariboo Mountains, and still further northward,—after an important interruption,—by the Omineca and Cassiar mountains. These mountains are, generally speaking, less rugged in detail than the Rocky Mountains, including extensive areas of high, rolling plateau-country, and supporting in their southern and more massive portion, numerous glaciers and wide snow-fields. The highest summit so far actually measured is Mount Donald, on the line of the Canadian Pacific Railway, 10,645 feet. The forests of the Purcell, Selkirk and Columbia ranges are dense and tangled, and these mountains are much more difficult to traverse, and even less perfectly explored

* The name Gold Range is often specially applied to that here spoken of as the Columbia Range.

than the corresponding portion of the Rocky Mountains. Granites and crystalline schists of great age are abundant in the Gold Range, together with great masses of Palæozoic rocks, respecting the structural relations of which very little is as yet known.

Principal
metalliferous
belt.

The Gold Range, as a whole, doubtless constitutes the most important metalliferous belt of the Province. The richest gold-fields are closely related to it, and discoveries of metalliferous lodes are reported in abundance from all parts of it which have been explored. The deposits already made known are very varied in character, including highly argentiferous galenas and other silver-ores and auriferous quartz veins.

Interior Plateau
of British
Columbia.

Between the Gold and Coast ranges, lies a region, which for purposes of description, has been named the Interior Plateau of British Columbia, having an average width of one hundred miles and a mean elevation of about 3500 feet. Its height, on the whole, increases to the south; while northward, it falls gradually toward the group of large lakes and the low country about the head-waters of the Peace. This has, over a considerable part of its area, been covered by wide-spread flows of basalt and other volcanic rocks in the later Tertiary period. It is now traversed in various directions by a system of deep, trough-like valleys of erosion, generally occupied by streams and rivers. Water standing at an elevation of three thousand feet above the present sea-level would flood most of these, and would divide its surface into a number of islands, while a large tract of country about the 53rd and 54th parallels of latitude would be completely submerged. In some places the plateau is pretty level and uniform, but many portions of it attain an elevation much exceeding the mean above stated, and it is usually only when broadly viewed, and in contrast with its bounding mountain ranges, that its character as a plateau is apparent. Its main area is practically closed to the north, about latitude $50^{\circ} 30'$, by the ends of several intercalated mountain ranges, in which many of the summits attain a height of 8000 feet. Nearly coincident with the 49th parallel, is a second transverse mountainous zone, formed in the same way, the only orographically important gap in which is that found in the vicinity of the Okanagan River. The southern portion of the Interior Plateau includes much open country, constitutes the best grazing region of British Columbia, and affords besides some good agricultural land. To the north, with increasing moisture, it becomes generally forested, but embraces large areas which are suitable for eventual agricultural occupation.

Geology of
the Interior
Plateau.

The Tertiary rocks of the Interior Plateau hold, in many places, beds of lignite or of coal. Where not concealed by the later rocks, the formations preponderantly represented belong to the Palæozoic age.

These
canic
that
toward
import
border
it is d
the pr
admit
been v
abund
The
of eru
due, th
course
vicinity
River i
and geo
menta
Cordille
Ranges
forming
continen
hundred
mountain
and tran
is betwe
are of f
of the C
and ext
character
while on
ranges,
Geolo
tion to
are foun
granites
and othe
some of
the last-
are frequ
The na
fourth ge

These include very notable developments of materials originally volcanic in origin. The geological structure is scarcely less complex than that of the mountain regions, and much yet remains to be done toward its elucidation. The Interior Plateau also presents some important granitic areas, and, particularly toward its south-western border, limited basins of Cretaceous rocks. As a metalliferous region, it is destined to take high rank, particularly I believe in respect to the precious metals, though its ores are too varied in character to admit of description in a few words. Placer deposits of gold have been worked in a number of widely separated localities, and platinum is abundant in the Similkameen region.

The Cascade Range of Oregon and Washington is largely composed of erupted volcanic materials, to which its characteristic features are due, though these materials rest upon a basis of older rocks. Its course is north-and-south, and it is definitely terminated in the vicinity of the International boundary. Near the mouth of the Fraser River its place is taken by a new mountain system, geographically and geologically distinct, in the composition of which volcanic ejectamenta play no prominent part. This forms the third member of the Cordillera in British Columbia, and under the name of the Coast Ranges, pursues a direct north-westward course for over 900 miles, forming throughout this distance the bordering mountain-zone of the continent. The Coast Ranges have an average width of about one hundred miles, and consist of numerous constituent ridges and minor mountain axes with varied trends, frequently separated by deep parallel and transverse valleys. The average altitude of the higher summits is between 6000 and 7000 feet, while some exceed 9000 feet. Glaciers are of frequent occurrence, and large in size, in the northern portions of the Coast Ranges. The mountains are, as a rule, densely forested and extremely rugged, the flora of their seaward slopes being that characteristic of the West Coast and coördinated with its great humidity, while on north-eastern flanks the forest resembles that of the inland ranges.

Geologically, the Coast Ranges owe the greater part of their elevation to a period later than the Cretaceous, of which formation patches are found in them at great heights. The rocks consist chiefly of grey granites and granitoid materials, with which are associated gneisses and other crystalline schists, as well as Palæozoic rocks resembling some of those of the Interior Plateau. In association principally with the last-named rocks, gold-placers occur locally. Copper- and iron-ores are frequently found, and rich silver-ores have been discovered.

The name Vancouver Range, may be applied as a general one to the fourth great mountain-axis, which, in a partially submerged condition,

The Coast
Ranges of
British
Columbia.

Rocks of the
Coast Ranges.

The Vancouver Range appears in Vancouver and in the Queen Charlotte Islands, and is continued southward nearly to the Columbia River by the Olympian Mountains of Washington Territory. The islands of the Alaskan archipelago have, on the map, the appearance of constituting a northern continuation of the same mountain system, but I believe that they may be more appropriately regarded, from an orographic point of view, as forming a partially submerged lateral expansion of the Coast Ranges. The highest mountain of Vancouver Island—Victoria Peak—reaches an elevation of 7484 feet, while there is a considerable mountainous area in the centre of the island, which surpasses 2000 feet in average altitude. Several summits in the Queen Charlotte Islands exceed 4000 feet.

Rocks of the
Vancouver
Range.

The Vancouver Range, while still to a considerable extent formed of crystalline rocks like those of the Coast Ranges, is principally composed of stratified rocks of Paleozoic and Triassic age, and is flanked in places, both on Vancouver and on Queen Charlotte Islands, by Cretaceous rocks, which are here important because of their coal-bearing character. The areas underlain by these rocks are in general comparatively low, and hilly rather than mountainous, while a large tract of level land, based upon the Tertiary formation, occurs in the north-east part of the Queen Charlotte Islands. Gold-placers have been worked in several places on Vancouver Island, but few ever attained much importance. Iron, copper and lead ores and gold-bearing quartz are also known to occur in connexion with this mountain-axis, but up to the present time the coal deposits have proved to be vastly its most important feature.*

GENERAL NOTES ON MINERAL DEPOSITS.

Similarity of
rocks in differ-
ent parts of
Cordillera belt.

The general correspondence of that portion of the Cordillera belt included in British Columbia with that of the western portion of the United States, in some parts of which mining operations of the first importance have been in progress now for many years, has already been alluded to. No feature of the geology of the continent is more remarkable, than the general persistence of certain zones of similar rocks in a direction coincident with that of the Cordillera itself,—a circumstance in part due to the original similarity in conditions of depo-

* In connexion with the foregoing outline of the ruling physical and geological features of the Province, it should be stated that while these features are moderately well known in the southern portion of the Province, and as far northward as the 56th degree of latitude, and that while in connection with the Yukon expedition some accurate information has been obtained for the extensive northern portion; there yet remains a large region, chiefly included between the 56th and 58th parallels, which, though touched upon here and there by the gold miner, is yet almost unknown geographically and geologically.

sition
in ch
thus o
direct
of the
trasts
occur
deposi
can be
tance,
the en
dynam
nearly
blances
respon
but it m
may wi
already
the Cor
ions, us
the dev
The I
scarcely
the main
of the C
may, how
tinued b
about 30
sents th
the Colu
though d
self-cont
importan
the Coast
the Inter
closely th
and Oreg
that held
to a time
the Coast
that perio
period wi
yond whi

sition of sediments, and in part to their equal participation, at a later date, in changes produced by like metamorphic agencies. The similarity thus observed, in a series of geological zones parallel to the general direction of the Pacific Coast, is here more striking than the continuity of the constituent orographic uplifts of the mountain-belt, and contrasts very markedly with the diversity of rock-formations found to occur where this belt is crossed at right-angles. While metalliferous deposits individually are inconstant, and even the best defined lodes can be followed, in the vast majority of cases, for but a moderate distance, their character is found to depend fundamentally upon that of the enclosing or adjacent rocks, in which, under the required local dynamic and other agencies, these deposits are found to recur with nearly identical features. It is not intended here to discuss the resemblances and differences of the various rock-series met with in the corresponding region in the Western States with those of British Columbia, but it may be mentioned, that the metalliferous districts of the Province may with advantage be compared by the miner with those which have already been more fully developed in each corresponding portion of the Cordillera region to the south, and that from such rational comparisons, useful indications may be derived in the present early stages of the development of the mines of British Columbia.

The Rocky Mountains proper, as defined on a previous page, can scarcely be traced southward, with identical characters, further than the main head-waters of the Missouri, beyond which the eastern ranges of the Cordillera become more lax and irregular. The Gold Range may, however, be followed further in a southerly direction, being continued by the Cabinet, Cour D'Alaine and Bitter Root mountains, for about 300 miles. The Interior Plateau of British Columbia represents the Great Basin of Utah and Nevada and the great plains of the Columbia, and combines to some extent the features of both, though differing markedly from the first in the fact that it is not here self-contained as to its drainage, and from the second, in the diminished importance of its Tertiary lava-flood. It has already been stated, that the Coast Ranges of British Columbia are not continued to the south of the International Boundary. They resemble the Sierra-Nevada more closely than they do the Cascade Mountains of Washington Territory and Oregon, and hold a similar relation to the Interior Basin with that held by the Sierra. While, however, the Sierra owes its elevation to a time immediately antedating the Cretaceous, the main uplift of the Coast Ranges of British Columbia occurred at or after the close of that period. The Vancouver Range, again, dating from the same period with the last, is not traceable south of the Columbia River, beyond which, in Oregon and California, the Pacific is bordered by a

Continuations
to the south-
ward of various
mountain
ranges.

range of coast hills, which, from a geological point of view, are of very recent origin.

Auriferous
rocks of
British
Columbia and
California
compared.

In California, the principal auriferous territory coincides with the run of a certain belt of slaty and schistose rocks, which occurs on the western flank of the Sierra-Nevada; these rocks being referred by their contained fossils, to the Triassic and Cretaceous divisions of the geological scale. In British Columbia, while rocks of Triassic age are largely developed, and in some cases with characters identical with those of the Californian gold-bearing rocks, no such persistent belt of these rocks is found in connexion with the Coast Ranges, where (from what has just been said of the resemblance of the two mountain systems) it might, from analogy, have been sought for. While local occurrences of rich gold-placers are known, in association with slates probably of Triassic age, on both sides of the Coast Ranges, the main auriferous territory in the Province is found to align itself on the Gold Range; and the original deposits of gold, from which the placers have been supplied, are already known to exist in different series of rocks widely separated in age and ranging all the way from the Triassic to the Cambrian. While, therefore, there is no single well developed gold-producing region, as in California, the area and mass of the rocks throughout which deposits of gold may be hopefully looked for, is here greatly increased. The circumstances would also warrant the belief, that the mode of occurrence of gold in its original matrix might differ from that found to the south, and in particular that this might be more varied. So far as investigation has gone such a belief appears to be well grounded, and it would seem, that to a very considerable extent, the natural laws of this mining field must be worked out independently.

No Tertiary
Coast Range
in British
Columbia.

In correspondence with the absence of the Tertiary Coast Hills of California, in which, under peculiar conditions of mineralization, the cinnabar ores of that State are developed, it is observable that in British Columbia no really important deposits of mercury have yet been discovered. It is by no means improbable that mercury-ores may yet be developed in the Province, but if so, it cannot be in any continuation of the Californian cinnabar belt, and the conditions of such deposits may be expected to prove unlike.

Coal-bearing
Cretaceous
rocks of British
Columbia.

Another and very important point of diversity, is found as respects the Cretaceous rocks of the southern and northern coast regions. In California and Oregon, the mineral fuels which have been found and worked are lignites of Tertiary age and of an inferior value. Similar fuels are known on the coast of British Columbia, but the rocks of the Cretaceous here assume the rôle of a coal-bearing series and yield coals of excellent quality, which more than hold their own in competition with all other fuels employed on the Pacific.

Still
is app
traste
duced
during
of sur
bearing
the sun
tending
to whic
At the
metalli
rock as
outcrop
the tre
work fr
regions
These
are am
to retar
Other c
the den
that the
remoten
districts
be regar
Owing t
been pro
deterred
rumour,
precious
for meta
were, it
often us
Even wh
original
quired fo
difficult t
which th
hand.
Y
province
While
vein-min

Still another noteworthy circumstance of difference, and one which is applicable to practically the entire area of the Province when it is contrasted as a whole with the Pacific States, is that which has been produced by the general spread and movement of ice over this region, during the Glacial period. The changes thus effected in the distribution of surface materials and directions of drainage have most important bearings on the question of placer-mining. They have also encumbered the surface of considerable tracts with "drift" deposits, which, while tending to produce a more fertile soil, largely conceal the indications to which the prospector generally trusts in more southern latitudes. At the same time, a great part of the oxidised upper portions of metalliferous veins, together with the atmospherically decayed country-rock associated with these, has been removed, thus often obscuring the outcrops of such veins, which would otherwise be well marked; and in the treatment of certain classes of ores, rendering it necessary to begin work from the first with machinery and processes which in some other regions are only required after considerable depths have been attained.

Effects of
glaciation.

These conditions, brought about by action during the Glacial period, are amongst those which, in my opinion, have most tended heretofore to retard the development of metalliferous mining in British Columbia. Other circumstances which have operated in the same direction are; the densely wooded character of a great part of the country, the fact that the rivers are suited for navigation only in detached reaches, the remoteness from the coast of the richest and best known placer-mining districts, and the cost of labour, supplies and machinery, which may be regarded as in part concomitants, in part direct results of these. Owing to the inaccessibility of the country, it has, till very recently, been prospected and exploited by the placer-miner alone, who has been deterred by no difficulty from reaching the most remote spots in which rumour, or reasoning of his own, lead him to expect the existence of the precious metal. Little knowledge or effort was expended in the search for metalliferous veins. Many such deposits supposed to be of value were, it is true, located, and time and money which could ill be spared, often uselessly spent upon them, leading only to discouragement. Even where the indications met with were altogether favourable, the original discoverer generally found that the capital and knowledge required for their development were not at his command, and it was difficult to interest those capable of dealing with such mines in a region which they could not easily visit and become familiar with at first hand. With regard at least to the whole southern portion of the province, however, all this is now happily changed.

Causes which
tend to retard
development.

While speaking of causes which have hitherto stood in the way of vein-mining, it must also be mentioned, that not the least important of

Exaggerated
values.

these has been, and still is, the fictitious or exaggerated value too frequently placed upon entirely undeveloped discoveries. While it is manifestly right that the discoverer should be properly remunerated, it should be remembered that a mere surface shewing, however promising, generally requires the expenditure of a large sum before its true value can even be ascertained, and that till thus developed it is unreasonable to expect a large payment for any mining claim.

Importance
of British
Columbia as a
metalliferous
region.

In preceding paragraphs, particular attention has been drawn to certain notable differences between the better known and more fully developed regions of the southern part of the Pacific Slope and those of the province of British Columbia, chiefly as a note of caution against the rash assumption of complete uniformity in conditions too often made without due investigation. The salient fact of the general identity of the structural features of the Cordillera region south and north, however, remain, and is such, that from this alone, even without taking into consideration the numerous and important discoveries already made, we should be justified in predicting an eventual great development of metalliferous mining in the Province. It has already been stated, that British Columbia includes a length of over 800 miles of the most important metalliferous belt of the continent, and adding to this the northern extension of the same belt, beyond the 60th parallel, we find that within the boundaries of Canada its entire length is between 1200 and 1300 miles. This, as I have elsewhere noted, is almost precisely equal to the whole length of the same region included by the United States from our southern line to the northern boundary of Mexico, and after having enjoyed, exceptional opportunities of investigation, I feel no hesitation in recording my belief that the northern moiety of the Cordillera will ultimately prove to be susceptible of a development corresponding in importance to that which has already been attained in the southern.

Rise and
progress of
mining.

British Columbia first rose from the position of a fur country to the rank of a colony, on the discovery of gold upon the Lower Fraser in 1858. Its subsequent history, for a number of years, is substantially that of the sudden rise and subsequent slow decline in importance of placer gold-mining. Coal mining has, however, concurrently, advanced slowly but steadily till it has obtained its present pre-eminent position. Such historical facts as appear to be important to the appreciation of these industries are touched on later in connexion with them. With respect to vein-mining proper, we have as yet to chronicle merely the first steps, but in the southern part of the Province the completion of the Canadian Pacific Railway, has at length afforded the necessary impetus in this direction, and it is very gratifying to find, as an immediate consequence, that this part of the country is rapidly beginning to

Present
position.

prov
best
quen
logic
soon
are s
be eq
and s
comp
widely
many
able c
that w
mining

PUBL

The
tended
provinc
ing on
which a
subsequ

Report of
ra
Co
no

Report of
Qu
De

Report of
Co

Report of
bia

Dawson
by
Report of
Col

Riv

Dawson

Dawson
Val

prove its valuable character and to justify the confidence which those best able to form an opinion on the subject have always felt, and frequently expressed. Everything which has been ascertained of the geological character of the Province as a whole, tends to the belief that so soon as similar means of travel and transport shall be extended to what are still the more inaccessible districts, these also will be discovered to be equally rich in minerals, particularly in the precious metals, gold and silver. In the southern district, for which information is most complete, praiseworthy efforts are now in progress at a number of widely separated localities, toward the exploitation of ores, which, in many cases, have already been proved to be of an exceptionally valuable character. Here at least, we have every reason to believe that we are on the point of witnessing the inauguration of an era of mining activity of the most important kind.

PUBLICATIONS BEARING ON GEOLOGY, ETC., OF BRITISH COLUMBIA.

The operations of the Geological Survey of Canada, were first extended to British Columbia in 1871, when the former colony became a province of the Dominion. Since that date a number of reports bearing on the Province have been published by the Geological Survey, which are here enumerated, as frequent reference is made to them on subsequent pages:—

Report of Progress 1871-72.—*Selwyn*: Journal and Report of Preliminary Explorations in British Columbia. *Richardson*: On the Coal Fields of the East Coast of Vancouver Island, with a map of their distribution. Appended notes by *Dawson* (J. W.) and *Hunt* on Fossil Plants and on Coals.

Report of Progress 1872-73.—*Richardson*: On the Coal Fields of Vancouver and Queen Charlotte Islands, with a map of the former; an Appendix by *Dawson* (J. W.) on Fossil Plants; another by *Billings* on Mesozoic Fossils; and a third by *Harrington* on the Coals of the West Coast.

Report of Progress 1872-73—*Richardson*: On Geological Explorations in British Columbia.

Report of Progress 1874-75.—*Richardson*: On Explorations in British Columbia.

Report of Progress 1875-76.—*Selwyn*: Report on Explorations in British Columbia, with sketch-map of route and appendices by *Macoun* on Botany; *iteaves* on Fossils; and *Le Conte* on Coleoptera.

Dawson (G. M.): Report on Explorations in British Columbia; Appendix by *Scudder* (S. H.) on Tertiary Fossil Insects.

Report of Progress 1876-77.—*Dawson* (G. M.): Report on Explorations in British Columbia, chiefly in the Basins of the Blackwater, Salmon and Nechacoo Rivers, and on François Lake, with a coloured Geological map.

Dawson (G. M.): Report of a Reconnaissance of Leech River and vicinity.

Dawson (G. M.): General Note on the Mines, and Minerals of Economic Value of British Columbia, with a list of Localities.

- Richardson*: Report on the Coal Fields of Nanaimo, Comox, Cowichan, Burrard Inlet and Sooke, British Columbia, with a coloured Geological map.
- Scudder (S.H.)*: Additions to the Insect Fauna of the Tertiary Beds at Quesnel.
- Report of Progress 1877-78.—Dawson (G. M.)*: Preliminary Report on the Physical and Geological Features of the Southern Portion of the Interior of British Columbia, with a coloured Geological map.
- Report of Progress 1878-79.—Dawson (G. M.)*: Report on the Queen Charlotte Islands, with two coloured Geological maps and sketches of Harbours. *Appendix A.*—On the Haida Indians of the Queen Charlotte Islands. *Appendix B.*—Vocabulary of the Haida Indians. *Appendix C.*—*Whiteaves*: On some Marine Invertebrata from the Queen Charlotte Islands. *Appendix D.*—*Smith (S. J.)*: Notes on the Crustacea from the Queen Charlotte and Vancouver Islands. *Appendix E.*—*Macoun*: List of Plants from the Queen Charlotte Islands. *Appendix F.*—Meteorological Observations. *Appendix G.*—Notes on Latitudes and Longitudes.
- Report of Progress 1879-80.—Dawson (G. M.)*: Report on an Exploration from Fort Simpson, on the Pacific Coast, to Edmonton, on the Saskatchewan, embracing a portion of the Western part of British Columbia and the Peace River Country, with a map in three sheets, with Geological Indications. *Appendix I.*—*Macoun*: List of Plants collected in the Northern part of British Columbia and the Peace River Country. *Appendix II.*—Meteorological Observations. *Appendix III.*—Note on Latitudes and Longitudes of the Region from the Pacific Coast to Edmonton.
- Dawson (G. M.)*: Note on the Distribution of some of the more important Trees of British Columbia, with a map.
- Report of Progress 1882-84.—Bauerman (H.)*: Report on the Geology of the Country near the Forty-ninth Parallel of North Latitude, West of the Rocky Mountains, from Observations made 1859-61.
- Annual Report, 1885.—Dawson (G. M.)*: Preliminary Report on the Physical and Geological Features of that portion of the Rocky Mountains between Latitudes 49° and $51^{\circ} 30'$, with two coloured Geological maps.
- Annual Report, 1886.—Dawson (G. M.)*: Report on a Geological Examination of the Northern part of Vancouver Island and adjacent coasts, with a coloured Geological map. *Appendix I.*—*Whiteaves*: Note on some Mesozoic Fossils from various localities on the coast of British Columbia. *Appendix II.*—*Macoun*: List of Plants from Vancouver Island and adjacent coasts. *Appendix III.*—Meteorological Observations.
- Annual Report, 1887.—Dawson (G. M.)*: Report on an Exploration in the Yukon District, N.W.T., and adjacent Northern portion of British Columbia, with an index map and a detailed map in three sheets, with Geological indications. *Appendix I.*—Note on the Distribution of Trees. *Appendix II.*—Note on the Indian Tribes. *Appendix III.*—*Macoun*: List of Plants. *Appendix IV.*—Zoology. *Fletcher (J.)*: List of Lepidoptera, etc. *Appendix V.*—*Adams*: Notes on Rock-specimens. *Appendix VI.*—Meteorological Observations. *Appendix VII.*—Astronomical Observations.
- Bowman*: Report on the Mining Region of Cariboo. Part I.

Besides the reports above enumerated, which are contained in the

annual volumes of the Geological Survey, the following special reports bearing on British Columbia have been issued by the Survey:—

Mesozoic Fossils. Parts I., II. and III., by J. F. Whiteaves. *Report on the Polyzoa of the Queen Charlotte Islands* by T. Hinks' *Comparative Vocabularies of the Indian Tribes*, by W. F. Tolmie and G. M. Dawson.

Various contributions to the geology of the Province and to the knowledge of its minerals, including several short reports by Mr. A. Bowman, are also to be found in the Annual Summary Report of the Geological Survey, and numerous analyses of ores and minerals are included in the Contributions from the Laboratory of the Survey from 1871-72 to date.

From the Annual Reports of the Minister of Mines of British Columbia, from 1874 to date, much valuable and detailed information may also be obtained.

In the following pages, placer gold-mining is given the first place, as it forms the natural introduction, from a historical stand point, to mining in general.

THE DISCOVERY OF GOLD.

The first authenticated discovery of gold within the limits of what is now the province of British Columbia, occurred at Mitchell or Gold Harbour, on the west coast of the Queen Charlotte Islands. This discovery created considerable interest at the time, but was in no way connected with the Fraser River excitement, and general commencement of placer-mining, which occurred later. As, however, the matter is of some historical interest, and as several versions of the affair have been given, the following notes derived from Mr. J. W. McKay, who was conversant with all the circumstances, at the time, are inserted here.—The first gold was a nugget accidentally found by an Indian woman on the beach in 1851. After a part had been cut off, it was taken by the Indians to Fort Simpson and sold there, weighing, as received, between four and five ounces. The nugget was then sent by the officer in charge, to the Hudson Bay headquarters at Victoria. The Company in the same year sent the brigantine *Una* to the place of discovery, where a quartz vein seven inches wide and traceable for eighty feet was found, and reported to contain twenty-five per cent. of gold in some places. Some of the quartz was blasted out and shipped, but the brigantine was lost on the return voyage, at Neah Bay, near Cape Flattery, in the month of December. In January, 1852, a U. S. brigantine, named the *Orbit*, which was on the rocks in Esquimalt Harbour, was bought by the Company, registered under the British flag, re-named the *Recovery*, and sent north with thirty miners in addition to the ships company, the

Original
discovery of
gold in the
Queen
Charlotte
Islands.

miners going 'on shares' in the venture. Three months were spent in getting a cargo of the quartz, which was eventually sent to England, the miners receiving \$30 a month each as the result. Meanwhile, the discovery having become known, several little vessels from San Francisco followed the *Recovery* to the Queen Charlotte Islands, and H. M. S. *Thetis* was sent from Valparaiso to keep order. The deposit proved, however, to be quite limited, and these vessels, as well as the *Thetis*, shortly left. Soon after, a vessel named the *Susan Sturgiss* arrived, and the captain (Rooney) collected a quantity of the quartz which had been discarded by the *Una* expedition, and taking it to San Francisco, realized \$1400 on it. A second trip made by this vessel in the same year, ended disastrously, the vessel being captured by the Indians at Masset, and the crew kept as prisoners for some time. All released by the Hudson Bay steamer *Beaver*. It would appear that gold to the value of about \$20,000 may have been obtained from this little vein, while an estimate as high as \$75,000 has been made.

Discovery of
gold-placers.

It is now difficult to ascertain under what precise circumstances the first discovery of gold placers on the mainland of British Columbia occurred. Little attention was at first given to accounts of the finding of small quantities of gold, and at a later date, when gold mining sprung into importance, numerous stories respecting its discovery were invented or exhumed.* One statement, is to the effect that the Hudson Bay Company's agent at Kamloops had bought gold from the Indians as early as 1852, but, if correct, the amount purchased must have been very small. In 1855, a servant of the same Company discovered gold near Fort Colville, a short distance south of the International boundary, and moderately rich diggings began to be worked in that vicinity. It seems certain that the epoch-making discovery of gold in British Columbia, was the direct result of the Colville excitement. Indians from the Thompson River, visiting a woman of their tribe who was married to a French Canadian at Walla-Walla, spread the report that gold, like that found at Colville, occurred also in their country, and in the summer or autumn of 1857, four or five Canadians and half-breeds crossed over to the Thompson, and succeeded in finding workable placers at Nicoamen, on that river, nine miles above its mouth. On the return of these prospectors the news of the discovery of gold spread rapidly. It is also probable that their arrival on the Thompson caused the Indians to take an interest in gold-mining, for we read in a despatch of Governor Sir James Douglas, that from October 6, 1857, to the end of that year, three hundred ounces of gold had passed through the hands of the Hudson Bay Company, this amount being all, so far as known to Douglas, which had been obtained.

Gold first
obtained.

* See Baneroff's Works. vol. xxxii, chapter xx.

It is i
in Briti
and for
future d

* Accordi
said to hav
At Hope 400

Douglas speaks of the region including the Lower Thompson, from which the gold came, as the "Couteau Country."

Nearly ten years previously, in 1849, gold had been discovered in California, and that country was swarming with a cosmopolitan population of gold-seekers; thus when the discovery of gold in the north became known and authenticated by the exhibition of the gold itself, an extraordinary migration followed. Between March and June, 1858, from 20,000 to 23,000 persons arrived by sea from San Francisco in Victoria, and converted that place (first founded by the H. B. Company in 1843) from a quiet village of 200 or 300 inhabitants, into a city of tents. At the same time, many miners (estimated by some at 8000 in number) reached British Columbia by overland routes from the south. A large proportion of those who arrived at Victoria never got so far as the mouth of the Fraser River, their objective point, and so great were the natural difficulties and the resulting disappointment experienced, that all but about 3000 of this promiscuous migration returned to California before the following January. The inland country was entirely without routes of communication, by nature a singularly difficult one, and unprovided with means for the support of a large population. Meanwhile, by the more fortunate and energetic, the development of its wealth had been fairly inaugurated. The auriferous river-bars in the vicinity of Hope and Yale on the Lower Fraser being the most accessible, were the first to be worked, and the return of gold began to assume important dimensions. The actual shipments made from Victoria during the first five months of work in 1858, are stated as below *.—

Influx of gold-seekers.

First shipments of gold.

June.....	\$ 6,000
July.....	45,000
August.....	45,000
September.....	164,000
October.....	283,000
	\$543,000

PROGRESS OF PLACER GOLD-MINING.

It is impossible here to follow the further progress of gold discoveries in British Columbia in detail, though such facts relating to discovery and former mining, as appear still to possess importance as guides to future development, are mentioned in connexion with the several dis-

* According to Macfie, Vancouver Island and British Columbia; London, 1865, p. 72. There are said to have been 4000 miners along the Fraser between Hope and Yale, in November, 1858. At Hope 400, and at Yale 1800.

tricts and localities to which they relate.* A few words must suffice to indicate in a general way the progress of the army of gold-miners, the outlines of the topographical features of the Province previously given, serving to acquaint those not personally familiar with it, with the salient features of the regions which were thus rapidly overspread.

Progress of
mining 1858
to 1860.

Before the close of the working season in 1858, some of the adventurers who had come overland from the south, had pushed onward in face of extraordinary difficulties,—resulting not alone from the roughness of the country itself but combined with the want of supplies and occasional overt hostility of the Indians,—as far as Fountain, a short distance above Lillooet on the Fraser, and by the line of the Thompson to Tranquille River on Kamloops Lake. In the following year a renewed advance brought a number of miners to the Quesnel River, and in 1860, rich diggings were found at The Forks of the river and over 600 Whites were at work on its length, while Antler Creek was discovered and some work done upon it by a few score men,—thus fairly entered on the extremely rich central region of Cariboo. Also in this year, good placers were found on the Similkameen, in the southern part of the Province.

Theory of the
miners.

The theory formed by the miners who first worked the fine 'flour' gold of the Fraser below Yale, was that this gold had its origin in richer deposits toward the sources of the great river, and though this theory was only very partially correct as regards the origin of these particular deposits, it none the less served as the impelling force which led to the opening up of the Cariboo district.

Early
discoveries
in Cariboo.

In 1861, Williams and Lightning creeks, Cariboo, the two most celebrated in the annals of British Columbian placer-mining, were discovered, and in this and the following year most of the other rich creeks in Cariboo became known. The first gleanings from the old Cariboo stream-courses were notable. It is estimated that gold to the value of \$2,000,000 had been got out by a population not exceeding 1500 before the end of 1861. In consequence of those finds a second important migration of miners and others towards the Province commenced before the close of 1861, which continued in greater or less volume till about 1864. A series of letters from a correspondent of the "Times" contributed largely to this result, and extended the area of interest to very wide limits, bringing adventurers from England,

* A mass of information respecting the historical and other features of gold-mining in the Province is contained in Bancroft's Works, vol. xxxii, History of British Columbia. The details there collected may be consulted with advantage, and have been frequently referred to in connexion with localities mentioned in later pages of this report. It must be added, however, that many of the statements quoted by Bancroft must be accepted with caution, having been derived often from the newspapers of the time, and other sources not always trustworthy, but which it has naturally been impossible for the compiler to check, and many of which call for as intimate local knowledge of the country, even to properly correlate.

Canada, Australia and New Zealand. A party of men even set out for Cariboo from Eastern Canada overland, in 1862. Of this party several members lost their lives in the mountains, but some eventually reached their destination.

A further consequence of the Cariboo excitement was to depopulate almost completely the other mining camps in the Province, even those which were yielding a good average return for work, some promising localities lying untouched for years afterwards, or falling entirely into the hands of the Chinese and Indians.

In 1863, however, rich placer deposits were found on Wild Horse ^{Discoveries on} Creek in the Kootanie region, the extreme south-east portion of the ^{Wild Horse} Province. These caused considerable local excitement at the time. ^{Creek and} and were somewhat extensively worked in the following year and thereafter, notwithstanding the attraction of Cariboo. In 1864, Leech River, in the southern part of Vancouver Island not far from Victoria, was discovered to be auriferous, and in 1865 a number of miners from the Kootanie district were prospecting and working in the neighboring Big Bend (of the Columbia) country, the report of their success resulting in the Big Bend excitement of 1866. This subsided almost as quickly as it had arisen, the number of men who rushed to the place being much too great for the opportunities of work.

Though miners from Quesnel, following the routes employed by the ^{Gold on} Hudson Bay Company, had reached and worked with some success on ^{Peace River} Peace River as early as 1861, it was not till 1869 that the richer ^{and Omenica.} deposits of the feeders of the Omenica Branch of that river near lat. 56° were discovered, and the Omenica excitement did not attain its height till 1871. In 1872, the rich northern mines of the Cassiar district, on the head-waters of the Dease, were brought to light, and a general migration in that direction occurred, which, in 1873, led to the almost complete abandonment of Omenica.

The discovery of the Cassiar mines carried the miners to the vicinity ^{Cassiar and} of the 60th parallel, the northern boundary of the Province. Gold was ^{Yukon.} next found in paying quantities on the tributaries of the Yukon, still further to the north, in 1880.* No such rush has occurred to this district as happened in the case of some of those previously mentioned, but in 1886, the miners were at work as far north as lat. 64° 30' having found 'course' gold there on Forty-mile Creek.

Granite Creek, a tributary of the Similkameen was found to yield ^{Granite Creek.} rich diggings, in 1885, and though it has not proved to be as important as at first hoped, it has led to renewed activity in its vicinity.

* Whymper states, however, in 1869, that gold had been found in minute specks by employees of the Hudson Bay Company before that date. Travels in Alaska and on the Yukon, 1869, p. 227.

Region of the
principal gold
deposits.

While it may now be safely affirmed that gold is very generally distributed over the entire area of the province of British Columbia, so much so that there is scarcely a stream of any importance in which at least 'colours' of gold may not be found, the enumeration of the principal discoveries of important mining districts, shows very clearly, that most of these are situated along the system of mountains and high plateaux which comprises the Purcell, Selkirk, Columbia and Cariboo ranges and their north-western continuations, lying to the south-west of the Rocky Mountain Range properly so called, and parallel in direction with it. Of all the gold-producing districts that of Cariboo has proved the richest and the most continuously productive.

YIELD OF GOLD.

Explanation of
table annexed.

The first part of the annexed table, extending to the year 1875, was originally prepared in Victoria by Mr. Charles Good (then Deputy Minister of Mines and Provincial Secretary) and the writer, in the winter of 1875-76. It was first published in the Annual Report of the Minister of Mines for 1875, and has since been republished annually in the same report, with the necessary additions. It is based throughout on the amounts of gold shipped by the banks, express and other companies from Victoria, this being the best available means of ascertaining the yearly product. It has from the first been impossible to ascertain the amount of gold annually taken away in private hands, largely by Chinese, and no account was obtained of the gold carried south from the Kootanie and Similkameen county, which did not pass through Victoria. To allow for these amounts, an addition of one-third is made to the amount actually known to have been exported, up to the year 1877. In some of the earlier years it is probable that this addition is an under-estimate, while the reverse may hold in the case of the years immediately preceding 1877. Subsequent to the year 1877, an addition of one-fifth only has been made in the British Columbian report. It will thus be apparent that the figures given can only be accepted as a near approximation to the actual yield.

Under the year 1887 a small quantity of bullion obtained from a quartz mine is added, but the amounts are otherwise entirely due to placer-mining.

* Wad
† Excl.

TABLE shewing the actually known and estimated yield of gold; the number of miners employed; and the average earnings per man, per year from 1858 to 1888, in the Province of British Columbia.

YEAR.	Amount actually known to have been exported by Banks, &c.	Amount added to represent gold carried away in private hands.	Total.	Number of Miners employed.	Average yearly earnings per man.
	\$	\$	\$		\$
1858 (partial return.) }	543,000	.....	*705,000	3,000	235
1859.....	1,211,304	1-3rd 403,768	1,615,072	4,000	403
1860.....	1,671,410	" 557,133	2,228,543	4,400	506
1861.....	1,909,589	" 660,529	2,566,118	4,200	634
1862.....	1,902,677	" 664,226	2,566,903	4,100	648
1863.....	2,935,172	" 978,391	3,913,563	4,400	889
1864.....	2,801,888	" 933,962	3,735,850	4,400	849
1865.....	2,618,404	" 872,801	3,491,205	4,294	813
1866.....	1,906,580	" 665,526	2,662,106	2,682	893
1867.....	1,860,051	" 620,217	2,480,268	3,044	814
1868.....	1,779,729	" 593,243	2,372,972	2,390	992
1869.....	1,331,234	" 443,744	1,774,978	2,369	749
1870.....	1,002,717	" 334,239	1,336,956	2,348	569
1871.....	1,349,580	" 449,860	1,799,440	2,450	734
1872.....	1,208,229	" 402,743	1,610,972	2,400	671
1873.....	979,312	" 326,437	1,305,749	2,300	567
1874.....	1,383,464	" 461,154	1,844,618	2,868	643
1875.....	1,856,178	" 618,726	2,474,904	2,024	1,222
1876.....	1,339,986	" 446,662	1,786,648	2,282	783
1877.....	1,206,136	" 402,045	1,608,182	1,960	820
1878.....	1,062,670	1-5th 212,534	1,275,204	1,883	677
1879.....	1,075,049	" 215,009	1,290,058	2,124	607
1880.....	844,856	" 168,971	1,013,827	1,955	518
1881.....	872,281	" 174,456	1,046,737	1,898	551
1882.....	795,071	" 159,014	954,085	1,738	548
1883.....	661,877	" 132,375	794,252	1,965	404
1884.....	613,304	" 122,861	736,165	1,858	396
1885.....	594,782	" 118,956	713,738	2,902	246
1886.....	753,043	" 150,608	903,651	3,147	287
1887.....	578,924	" 115,785	693,709	2,342†	296
1888.....	513,943	102,788	616,731	2,007	307

Total known and estimated yield of gold, 1858 to 1888... 54,108,804

Average number of miners employed yearly..... 2,775

Average earnings per man per year..... 622

* Waddington's estimate.

† Exclusive of a number of men working on or prospecting for quartz.

Changes made
in table as here
published.

In comparing the years 1858, 1862 and 1863 of the above table with the same years as represented in the table as formerly published, it will be observed that the amount of gold is increased. This arises from the circumstance that some additional returns of exports, not accessible when the table was first prepared, have now been taken into consideration. These returns are to be found in Macfie's Vancouver Island and British Columbia and in Bancroft's Works, Vol. XXXII. There appears to be no doubt of the authenticity of these returns, and their addition brings the average earnings of the miners employed in the years in question into better correspondence with the number of the miners and with what is known of their success at the time.

Fluctuation in
gold yield.

The most noticeable point brought out by the table is the great yield of gold resulting from the discovery and early years of working in the Cariboo district, and the gradual and scarcely interrupted decline in the product of the placers which has since occurred. The gold-yield also, however, shows a fluctuation from year to year, particularly when it is considered in connexion with the number of men actually at work. This depends not alone upon the uncertainty of the deposits worked and the development or otherwise of new fields, but also to a considerable extent on varying climatic conditions, some seasons being very unfavourable to placer-mining on account of floods or prolonged high water.

GOLD MINING DISTRICTS.*—*Placer.*

Fraser and Thompson Rivers.

Character of
the Fraser.

The Fraser carries to the sea a great part of the entire drainage of the interior of British Columbia. At its mouth, the great quantity of detritus which it has brought down has formed an extensive delta. Followed up to the vicinity of Hope, its valley becomes defined by bordering mountain-ridges which gradually converge to the mouth of the cañon at Yale. This lower part of the valley must be regarded as an ancient salt-water inlet which has been filled up by the material transported by the river, the harder and older rock-bottom of the valley being generally covered to a great depth. Between Yale and Boston Bar, (nearly opposite North Bend on the Canadian Pacific Railway,) it breaks through the axis of the Coast Ranges, flowing in a series of

* For administrative purposes, and in connexion with mining, the following districts are recognised by the Government of British Columbia.—Cariboo, Cassiar, Omineca, Lillooet, Yale, West Kootanie, East Kootanie. Some of these districts are very extensive, and the term district is here employed in a more restricted, if somewhat less definite sense, as a convenient one under which to group the various metalliferous occurrences. Thus the Cariboo district technically includes the Parnip River and upper part of the Peace River, while from the point of view of placer-mining, these are more appropriately treated of under the heading Omineca.

wild rapids through a ragged gash in the mountains. Along the sides of this cañon a scarcely passable goat track existed when the gold-miners first arrived on the scene. Beyond Boston Bar, the valley becomes a direct and deep north-and-south furrow all the way to Fort George in latitude 54°. The southern part of this portion of the valley cuts obliquely through the inner tiers or flanking ridges of the Coast Ranges, but its northern and upper part is excavated in the plateau of the interior, to the east of these ranges. From the point of view of the gold-miner, the Fraser may be regarded as a gigantic ground-sluice. Its valley, originally excavated in Tertiary times, in the rocky substratum of the country, was subsequently, during the glacial period, largely filled with drift material; through which, at a still later date, the river has had to re-excavate its bed, leaving great series of terraces or "benches" along its banks in many places, as this was gradually accomplished. A portion of the gold now found in its bed and banks has without doubt been worn out of its rocky matrix directly by the action of the river and its immediate tributaries, while another portion may have been derived from the glacially transported drift materials. The first-mentioned moiety may be supposed to include the 'coarse' gold, the last must be in great part 'fine' gold.

Origin of the gold.

A great proportion of all this gold, from whatever source derived, has been gradually concentrated in the river-bottom by the action of the stream, while in many places paying deposits have been left upon the surfaces of 'benches' at various levels, or buried beneath their material, each such 'pay streak' representing some portion of a former bed of the river which has been left behind as erosion progressed. Thus when the work of 1858 and 1859 began, the miners obtained, with comparative ease and in a short time, a large quantity of gold. How much gold has been obtained from the Fraser and the lower part of the Thompson it is impossible to ascertain, but it may be stated that practically the entire output of the Province for 1857 and 1858, with the greater part of that for 1859, was derived from this river, and by far the larger portion from that part of the Fraser extending from Hope to the mouth of the Quesnel. The aggregate yield for these early years alone cannot be placed at less than \$1,700,000.

Distribution and quantity of the gold.

The mode of working these gold deposits was comparatively a simple one. The so-called 'bars' were nothing more than portions of the river-bed, which, being left bare at low water, could be reached by the miner. They varied in richness not only in different parts of the length of the river, but also in correspondence with the local relation of the currents and set of the stream. They were worked generally to but a very limited depth, being often merely skimmed over, in con-

Character of deposits.

Mode of working.

sequence of the trouble from water and the cost of removing any considerable thickness of non-remunerative material to reach deeper underlying 'pay streaks.' Most of the work was accomplished with the primitive rocker, and in 1858 no other means was employed on that portion of the river below Yale. At Yale, and further up, even in that year, sluicing was resorted to in some places, and a number of short ditches were constructed for the purpose of bringing water to the places worked. There were also, from the first, certain 'dry diggings' recognized and worked; these bring auriferous layers in river-flats or benches which were above the high-water mark of the stream. When the exciting discoveries in Cariboo district became known, the Fraser was almost abandoned, long before its placers had ceased to be remunerative, but since that time more or less desultory work along the Fraser and Thompson has never ceased. A great number of the high benches have been in part superficially worked, and have in some cases yielded excellent results. In the bed of the river itself, at each season of flood, a partial re-arrangement of material occurs, and additional supplies of gold are brought in by the wearing away of the banks, a feature having important bearings on the probable successful application of hydraulic mining to some of these deposits.

Partial
abandonment
of the Fraser.

Though no longer exceptionally rich, the bars and benches of the Fraser seem to afford a practically inexhaustible supply of gold. Had no further discoveries occurred in the north, the Fraser would not so soon have been deserted by the energetic white population, but with the gradual improvement in methods of mining would have been made to yield a vastly greater amount of gold than it has yet produced. Nothing illustrates this fact more forcibly than the table given below of the annual yield of the river during late years. Hill's Bar, near Yale, has probably afforded more gold than any other single locality on the Fraser. It was estimated to have produced in all, (to 1875,) not less than \$2,000,000 worth of gold from a total area of less than half a square mile. (Report of Minister of Mines of B. C., 1875, p. 17.) Its position at the foot of the very rapid portion of the Fraser, where the river first frees itself from the cañon and expands to a greater width, with a slackier current, is a suggestive one in respect to the origin of its gold. Instances of the yield of other bars are given in connexion with their enumeration on page 115 R, *et seq.*

Hill's Bar.

of
eve
usu
wh
retu
mos
retu
year
in C
the
Rive
whic
\$2,90
It
min
of w
the
mater
profit
depos
the w
and t
for m

Partial statement of value of gold derived from the Fraser River and some of its tributaries, approximately as included in the list of localities, pp. 115 R to 119 R, 1874 to 1888.

1874.....	\$ 55,000
1875.....	50,000
1876.....	42,000
1877.....	37,000
1878.....	14,000
1879.....	54,000
1880.....	93,300
1881.....	75,184
1882.....	70,200
1883.....	73,000
1884.....	122,934
1885.....	123,700
1886.....	157,000
1887.....	126,000
1888 (partial, not including Lower Fraser).....	90,160

The above table is derived from the returns in reports of the Minister of Mines of British Columbia. It is, unfortunately, very imperfect, even for the years which it professes to represent. It is more than usually difficult to obtain returns from the Chinese and Indians, in whose hands a large part of the work done here is. In addition, the returns for the several years are not strictly comparable, and do not in most cases include all the several localities referred to in the title. No returns appear to have been obtained from the Lillooet region in some years, and in others a portion of the upper part of the river is included in Cariboo district. I believe it would not be excessive to estimate the yield of the Fraser, including the Main Thompson River, Bridge River, and the Lillooet country at \$100,000 per annum since 1860, which would give a total yield from that date to 1888, of about \$2,900,000.

It scarcely I believe admits of doubt, that extensive and successful mining enterprises based on the application of the hydraulic method of working, will yet be instituted along a great part of the length of the Fraser valley, while dredging or other methods by which the materials of the bottom may be obtained and treated, may also be profitably employed. The great extent of the bench or terraco deposits of the valley, with the excellent opportunity of disposing of the waste, offer exceptionally favorable conditions for hydraulic work, and tributary streams with a sufficient quantity and head of water for mining purposes are not wanting.

Importance of recording observations on placers.

On a subsequent page, a list is given of the principal bars and diggings which were formerly worked along the Fraser River. This list is as complete as the available information permits, both in regard to the names and positions of the bars, and in respect to their yield and the quality of the gold. It may be objected, that as many of these deposits have now ceased to be continuously worked, such a list possesses merely a historical interest. This, however, is far from being true. It is of importance, not only as a guide to the selection of localities for hydraulic or other similar systematic work on a large scale, but also as affording a clue to the places of origin of the gold, and in directing the search of the explorer who is in quest of paying deposits of gold in its original matrix.

'Coarse' and 'fine' gold.

It is unfortunate that so much of the practical information obtained by the early miners is now irrecoverably lost, but an examination of that which I have been able to obtain is sufficient to lead to certain general conclusions. Nothing has been more certainly ascertained in connexion with placer-mining in general, than that the 'coarse' or 'heavy' gold, unless under very exceptional conditions, does not travel far from the place of its origin, even in very rapid streams. 'Scale' or 'flour' gold may, however, be transported to great distances by a river such as the Fraser, before it finds a final lodgment, or becomes reduced by attrition to invisible shreds.

Fine gold on the lower river.

The lowest bar on the Fraser which was found to yield remunerative returns, was Maria Bar, about twenty-five miles below Hope, and nearly opposite the mouth of the Chilliwack River. Thence to Hope, and in the neighborhood of that place, all the gold found was 'flour' gold, of great fineness. In ascending from Hope to Yale, however, it was observed that the bars became richer and the gold was often not so fine. It is highly probable that all this gold was transported by the river itself, and that none of it has a local origin. From a point on the river a few miles below Boston Bar (or about sixteen miles above Yale) to Sisco Flat, a short way below Lytton, a distance in all of about twenty-five miles, rich deposits of 'heavy' gold were worked. Further up the river is a second run of 'heavy' gold, the limits of which cannot now be so well defined, but which appears to have extended from a point about half way between Lytton and Foster's Bar, to some little distance above Fountain. Here nuggets of some size were occasionally unearthed, and there were some exceptionally rich diggings. On the Thompson, the vicinity of Nicoamen, where the original gold discovery occurred, has always been noted for its 'coarse' gold.

Runs of coarse gold.

Connexion of coarse gold with rock-formations.

On comparing the portions of the Fraser River thus found to yield 'coarse' gold with the rock formations of the country, it is found that

the first described run of 'coarse' gold corresponds almost exactly with that portion of the valley which is excavated in certain schistose argillites and micaceous and other schists of dark colour to which the name of Anderson River series has been provisionally assigned. It must, however, further be remarked that a series of Cretaceous argillites, conglomerate and sandstones which have probably been deposited in a still earlier hollow excavated along the out-crop of the soft rocks of the Anderson River series, also runs parallel to this part of the river, on its east side; and that while it is probable that the gold has originally been derived from the Anderson Rivers eries, a portion of that now found in the river may have been obtained by the robbing of Cretaceous placers contained in these later rocks. This is rendered all the more probable, by the fact that the second run of 'coarse' gold again corresponds with a similar trough of Cretaceous rocks, in the bottom of which, though the occurrence of the Anderson River schists is known in some places, (as near Lillooet), these older rocks are not extensively exposed by the present river.

Near Nicoamen, on the Thompson, the 'coarse' gold is found along a portion of the river which follows the junction of granitic rocks with the edge of a great thickness of Tertiary rocks, chiefly of volcanic origin. I have supposed that the gold may here occur in a disseminated form in some of the volcanic rocks or may possibly have been robbed from Tertiary placers occurring beneath the volcanic part of the series.

The 'coarse' gold is, in any case, on these rivers, distinctly in association with certain geological conditions which offer a fairly certain clue as to the rock-formations in which it should be sought for, either in the form of lodes, or in a disseminated state in certain beds. The precise location of exceptionally 'coarse' gold in certain bars and benches, making due allowance for a certain amount of movement down stream, should further give an indication of the actual localities in which the search for gold in its matrix may be engaged in with the greatest prospects of success.

It may further be observed, that gold has been found on the Anderson River, on Lillooet River and on Bridge River, all nearly on the line of strike of the Anderson River series and the overlying Cretaceous rocks, in such a manner as to mark out pretty distinctly the course of an auriferous belt to the east of, and parallel with, the axis of the Coast Ranges.

Coarse gold
at Nicoamen.

Guidance in
search for
gold-ores.

Belt of gold-
bearing rocks.

Cariboo District.

The Cariboo district,* entered by the miners in 1860, has ever since produced the greater part of the gold of the Province. It has proved to be one of the best 'placer-mining camps' ever discovered, and though most of the heavy runs of gold on bed-rock, so far found, may now be considered as worked out, its capability as a field for placer-mining of one kind or other, is by no means exhausted, and the very limited area within which some of the richest finds have occurred, encourages the belief that no great difficulty will eventually be found in tracing these alluvial deposits to their sources.

Physical
characters
of the Cariboo
district.

The fifty-third parallel of north latitude passes through the centre of the Cariboo mining district, which may be described as a mountainous region, but is perhaps rather to be regarded as the remnant of a great high-level plateau, with an average elevation of from 5000 to 5500 feet, dissected by innumerable streams which flow from it in every direction, but all eventually reach branches of the Fraser River. These streams, falling rapidly about their sources over rocky beds, descend into great V-shaped valleys, and, with the lessening slope, the rock becomes concealed by gravel deposits, which increase in thickness and extent till the valleys become U-shaped or flat bottomed, and little swampy glades are formed, through which the stream flows tortuously and with gentle current. The steep-sloping banks of the valleys are densely covered with coniferous forest, of which comparatively little has been destroyed by fire, owing to the dampness of the climate at this great altitude. The surface of the broken plateau above is often diversified by open tracts, affording good pasture in summer; and the whole country is more or less thickly covered by drift or detrital matter, concealing the greater part of the surface of the rocky substratum.

Progress of
mining.

As in all new gold-mining districts, the shallower placer deposits, and gravels in the present stream-courses first attracted attention, but with the experience of California and Australia, it was not long before the 'deep-diggings' were found to be far the most profitable. Williams and Lightning creeks have, so far, yielded the greater part of the gold of Cariboo. They were known from the first to be rich, but have been found specially suited for deep work, in having a hard deposit of boulder-clay beneath the beds of the present water-courses, which prevents the access of much of the superficial water to the workings below. By regular mining operations, the rocky bottom of the valley is followed beneath fifty to 150 feet of overlying clays and gravels, the

Deep mining
and old
channels.

* This term is here used in a restricted sense, being applied to the mining region, and not to the much more extensive electoral district of the same name.

course of the ancient stream being traceable by the polished rocks of its bed, and the coarse gravel and boulders which have filled its channel. In the hollow of the rocky channel the richest 'lead' of gold is usually found, but in following the rock-surface laterally, side-ground, rich enough to pay well, is generally discovered for a greater or less width. The old stream-courses of the Cariboo district are found to have pursued very much the same directions that their present representatives follow, crossing often from side to side of the valley with different flexures, and occasionally running through below a point of drift material projecting into the modern channel, but never, I believe, actually leaving the old valley or running across the modern drainage system, as is so often the case in the deep placers of California and Australia.

The most important deep work was carried out in the old pre-glacial and buried channels of Williams and Lightning creeks, where it has now practically almost ceased. As the methods employed are, however, of interest in illustration of the mode of occurrence of the richer gold deposits, and may yet be applied to other valleys even in this district, the following description is included. It will serve as a general description of this class of mining, and is substantially the same with that given in the previous publication on the mines of British Columbia, and refers particularly to the work in progress at the time of my visit to Cariboo in 1876.

Deep mining
on Williams
and Lightning
Creeks.

To reach the buried channel, on which it is generally impossible to sink directly through the superposed loose and watery materials, a shaft is usually sunk at the lower, or down-stream end of the claim, on the sloping side of the valley, where, after having gone through a moderate depth of clay or gravel, the slaty rock of the district is reached. The shaft is then continued through this, till a depth supposed to be sufficient is attained, when a drift is started at right angles to the course of the valley, and if the right depth has been chosen,—either by rough estimation, or calculation based on that required in other neighbouring workings—the old channel is struck in such a way as to enable the subterranean water collecting in it from the whole upper part of the claim, to be pumped to the surface by the shaft. On driving out of the slate rock, however, into the gravel, so much water is frequently met with that the pumps are mastered, rendering necessary a cessation of work till the latter part of the season, or the application of more powerful machinery. When the drift is not found to be at a sufficient depth to cut the bottom of the old channel, it is generally necessary to close it, and after continuing the shaft to a greater depth, to drive out again. The old channel once reached, and cleared of water, is followed up its slope by the workings, to the upper part of the claim, and where paying side-ground occurs this is also opened.

Shaft-sinking.

Drifting.

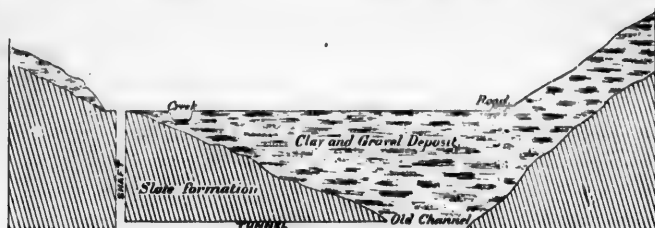


Fig. 1. Section across Lightning Creek valley at the lower end of Victoria Claim, shewing position of old channel, etc. From report by J. Evans, in Report of Minister of Mines of British Columbia, 1875. Approximate scale 120 feet to one inch.

Character of
the buried
deep channel.

The richest pay is generally obtained in the actual channel of the old stream, but where this is much contracted the force of the water is often found to have swept the gold away to those places where its width is greater. The harder rocks still preserve their polished and water-worn forms, but most of the slates are rotten and crumbling, to a considerable depth, and in cleaning up in the bottom, a thickness of one to two feet is frequently taken out with the pick and shovel, and sent up to the surface with the overlying gravel, for treatment. In the side-work, as in the central channel, the greater part of the gold is found lying directly on the 'bed-rock,' though, in some cases, particularly on Williams Creek, paying layers occur in the gravel several feet above it. The side-ground is worked up from the channel in successive breasts parallel to it.

Deposits of
old channels.

The lowest layers of gravel generally contain many large boulders of quartz and slaty fragments not much water-worn, which must have come down from the hill-sides; the appearance being that of deposit by torrential waters to a depth of four to six feet in the channel, above which the gravel is generally better rounded, and more evenly spread, though still mixed with clayey matter.

Difficulties
from water, etc.

In consequence of the unconsolidated nature of the gravel, the pressure on the supports of the workings is often excessive. The sets of timber are, in some places, only a few inches apart, and the whole of the workings have, in some cases, to be lined with complete lagging. The timber used is usually massive, being from one to two feet in average thickness, and consisting of the spruce of the country, simply barked and sawn into lengths. Its cost delivered at the mine at the date mentioned, was eight cents per running foot, all suitable sizes being taken at the same rate. The lagging, which is merely split out, four feet long, five inches wide, and two thick, cost seven dollars a hundred pieces. With every precaution, the timbers are frequently crushed by the pressure, or the uprights even forced downward into the slate.

Where large boulders are removed from the sides, or 'slum' is found, spruce brush requires to be extensively used behind the lagging, and in many places the water streams from the roof like a heavy shower of rain.

The whole of such deep workings were, as a rule, annually filled with water at the time of the spring floods, and it was sometimes not till late in the summer or autumn that the pumps again acquired the mastery. Flooding of workings.

The following are particulars referring to the Van Winkle mine on Lightning Creek, which was the most successful in operation at the time of my visit in 1876. Van Winkle mine.

The claim covered about 2050 feet in length of the valley, the deepest part of the old channel of which had been cleared out to a length of between 1600 to 1700 feet in October of 1876. Much side-ground, however, yet remained, and the workings sometimes attained a width of from 200 to 300 feet in following this up as far as it could be made to pay. The claim yielded the first dividend in December, 1873, \$40,000 having been expended before gold was reached in the channel. It afterward paid handsomely, having produced in one week gold worth \$15,700, and on other occasions at the weekly 'clean-up,' sums of \$14,000, \$12,000, etc. At the date above mentioned the total product of gold had amounted to the large sum of \$500,965.

In the Van Winkle mine, the average depth of the workings was about seventy feet only, the lowest shaft being placed 300 feet from the stream, on the opposite side of which the rock rises to the surface, forming steep cliffs. The water was raised to within forty feet of the surface, when it was discharged into an adit 3000 feet long, which was also used by other claims. There were two pumps, ten inches in diameter, the power being supplied by an eighteen-foot breast-wheel. This did not, however, represent the total volume of water pumped, as the ground of this claim was partly drained by others lower in the series, in which work could not be carried on till late in the season. In October of 1876 the following companies on Lightning Creek were driving their pumps day and night, the Van Winkle being the only mine clear of water:— Water pumped.

Costello Claim.—Pump, twelve inches diameter, nine-foot stroke, making ten strokes a minute.

Vulcan Claim.—Pump, twelve inches diameter, six-foot stroke, making eighteen strokes a minute.

Vancouver Claim.—Pump, twelve inches diameter, nine-foot stroke, making ten strokes a minute (double acting).

Van Winkle Claim.—Pumps, ten inches diameter, fourteen-foot stroke, making ten strokes a minute (two pumps).

The quantity of water being raised at this time would, therefore, amount to about 13,870 gallons a minute, or 19,874,000 per diem.

In many cases the machinery and appointments used in mining on the deep channel were very creditable, and almost the whole of this work was paid for by the miners of the district itself. Money gained in one enterprise was usually invested in another, and the share-holders in a mine were frequently to be found themselves at work in it.

Length of
working on
deep channel.

On Lightning Creek, the old deep channel has been followed and worked out to a length of about 16,000 feet in all, and in addition a number of rich bench claims and tributary creeks have yielded good returns. In endeavoring to 'bottom' the old channel further down the valley, very great difficulty is encountered, in consequence of the quantity of water and the increased depth of the sinking required. The Eleven of England is the lowest claim in which the old channel has been reached, and though evidence was here found, in the finer character of the gold, of increasing distance from the main sources of supply, it is probable that still lower portions of the valley may be proved to pay, with improved facilities.

Yield of claims
on Lightning
Creek.

It is impossible to present complete returns of the amount of gold obtained from the old bed of Lightning Creek, but the following approximate statement to November 1st, 1875, published in the report of the Minister of Mines of British Columbia for 1875, is still of interest in showing how large this amount, in the aggregate, must have been. The claims are here arranged in their order following down the creek.—

Campbell and Whitehall	\$200,000
Dutch and Siegel (now Perseverance).....	130,000
Dunbar	30,000
Lightning	153,962
Discovery and Butcher.....	120,000
South Wales.....	141,531
Spruce	99,908
Point	136,625
Van Winkle.....	363,983
Victoria	451,642
Vancouver	274,190
Vulcan.....	56,955
Costello	20,476

It would probably not be an exaggeration to state that the deep channel, for the portion of its length above referred to, with the adjacent side ground worked at the same time, has yielded throughout gold to the value of over \$200 to the running foot.

Williams Creek

On Williams Creek, on which the towns of Barkerville and Richfield are situated, the chief workings have been in a space of about two miles and three-quarter in length. In this the deep channel has been worked

through, and also as much of the side-ground as would pay at the time at which the mining took place. Many of the lateral creeks and gullies here have paid remarkably well; and the hill-sides, in some places to a height of a hundred feet or more, have proved to be sufficiently rich for the hydraulic method of working, which is now profitably carried on. Though Williams' Creek has produced in the aggregate the greatest amount of gold, Lightning Creek showed for a time a larger annual yield.

'The Cañon' between Barkerville and Richfield divides Williams Creek into two parts. For about half-a-mile above it, the ground was ^{ground above and below} 'The Cañon.'

shallow, and has been worked open to the bed rock. Further up, deep drifting was practised in former years and hydraulic work is now carried on. Below 'The Cañon,' all the work has been deep, in the old channel, although 'pay streaks' were sometimes found after getting down about twenty feet, these were usually disregarded in early days. In the Cameron claim, however, half-a-mile below Barkerville, the dirt paid nearly to the surface, and was worked in stages from below after the old channel had been cleared out. The workings were about sixty feet deep at Barkerville, only thirty-five feet at the former site of Cameronton, and at the Ballarat claim,—three-fourths of a mile below Barkerville—eighty feet. This is one of the lowest claims in which the old channel has been bottomed, and most of the gold obtained was light and scaly. The valley is here wide, the present stream turning abruptly to the west, while a wide, low hollow, known as Pleasant Valley, runs off in the opposite direction, to Antler Creek. It is supposed by many, that the main channel of the ancient water-course turns off in this direction, but owing to the great quantity of water and loose character of the ground, neither this nor the present valley of Williams Creek below the Ballarat, has yet been proved, though much money has been expended in the attempt. The Lane and Kurtz Company went to great expense in importing machinery and erected very complete works some years ago, but did not succeed in proving their ground, and have since abandoned the attempt. The place at which this work was carried on is known as 'The Meadows,' the valley here opening out and becoming wide and flat-bottomed. The Company held a concession covering about four miles in length of the valley, but succeeded in reaching a depth of 125 feet only, and in drifting out found that they were still too high for the deep channel, while the volume of water was greater than their pumps could master.

As showing the great local accumulation of gold in the deep channel of Williams Creek, and indicating its local origin, the following ^{Yield of various claims.} approximate statement of the value of gold obtained in various claims, covering certain lengths of the channel, is important. All these claims

were below 'The Cañon,' but they do not form a consecutive series, no such details being available for many other claims.—

Adams.....	100 feet.	\$ 50,000
Steele.....	80 "	120,000
Diller.....	50 "	240,000
Cunningham	500 "	270,000
Burns.....	80 "	140,000
Canadian.....	120 "	180,000
Neversweat	120 "	100,000
Moffat.....	50 "	90,000
Tinker.....	140 "	120,000
Watty.....	100 "	130,000
1340 "		\$1,440,000

Prospects for
further work
on Williams
and Lightning
Creeks.

In Cariboo district, even to the present time, the prices of labour and supplies have never been lowered to a point at which it would be profitable to work any but the richer deposits, which in the nature of things bear a small proportion to those capable of yielding a moderate or small amount of gold; and in working over the deep ground in early days much was left that would even now pay handsomely, but cannot be found or reached on account of the treacherous nature of the moved ground, filled with old timbering and water. On both Williams and Lightning creeks, but particularly in the former, there must be a great quantity of gold in ground of medium richness even yet. To render this gold available, however, and to prove successfully the lower and more difficult parts of the valleys, greater and more exact engineering knowledge, better and larger machinery, and, above all, cheaper labour and supplies, dependent on greater facilities of transport, such as would result from railway connection, are required.

Bed-rock Drain
and Flume.

The most important works of a general kind which have so far been carried out in Cariboo district are the Ped-rock Drain and Bed-rock Flume, on Williams Creek. The first of these is a tunnel which runs through all the old deep workings, beginning at the lower end of the part of the creek called 'The Cañon' (about 1000 feet above Barker-ville) and running out in 'The Meadows.' The total length of this tunnel is about one and one-eighth mile, and the cost of its construction is estimated at about \$100,000. The Flume, constructed in 1865, begins about 1000 feet above the head of the Drain, at the upper end of 'The Cañon.' It is a cutting averaging about twenty feet in depth and a mile in length, and is estimated to have cost about \$250,000. Into it the small flumes of the various companies working along the creek discharge, and it has also served for the working of the ground belonging to the Flume Company. By means of the free drainage

* From the
† Possibly
estimated to be

afforded by these works, a great part of the later mining has been rendered possible.

As an illustration of what might be done in this way, it may be mentioned, that it has been suggested, that by cutting a flume to Antler Creek—part of which would require to be a tunnel—free drainage of the whole upper part of Williams Creek would be obtained, and if the grade should prove to be sufficient on survey, it would enable the valley from its sources to the flume level, with all its old workings, and the great depth of tailings holding more or less gold which has accumulated, to be completely stripped by extensive hydraulic works.

In the above general notes on Cariboo district, Williams and Lightning creeks have been particularly referred to as exemplifying the conditions there found, and the methods employed in working the old deep channels. These two creeks have, besides, yielded by far the greater quantity of the gold, and on them the pre-glacial channels have been found to be continuous, and though deep, specially well adapted for working. Underground drifting on old channels has, however, been practised, as well as several other creeks, of which Keithly, Harvey, Grouse and Mosquito creeks may be specially mentioned. There are besides a number of creeks which have yielded much gold by surface work or in open sinkings of moderate depth, portions of which still remain, which it is confidently believed by miners would prove rich in deep ground if properly explored. Antler, Cunningham, and Jack-of-Clubs creeks with Willow River are supposed to be specially promising from this point of view, and though attempts have been made from time to time to test the deep ground on several of these, it has not yet been successfully accomplished. On Antler Creek; in particular, the Dawson Company has been at work with this object for a number of years, and has not yet abandoned the efforts.

*Approximate statement of value of gold produced by Cariboo District, from 1874 to 1888.**

1874 (partial)	\$ 700,000
1875	1,075,237 †
1876	646,000
1877	411,402
1878	380,535
1879	500,000
1880	564,000
1881	610,737
1882	471,525

* From the Reports of the Minister of Mines of British Columbia.

† Possibly too high. Lightning Creek was, however, yielding well in this year, and was estimated to have produced \$500,000 of this amount.

Possible flume
to Antler Creek

Unproved deep
ground on
other creeks.

Gold yield of
Cariboo district

1883.....	457,787
1884.....	423,855
1885.....	347,700
1886.....	288,300
1887.....	247,673
1888.....	250,377

Remarks on
yield.

The amounts above assigned to the various years are merely approximate, particularly for the earlier years of the series, the returns for which are extremely imperfect. The table as a whole, however, illustrates the large amount continuously afforded by the Cariboo district from a period beginning more than ten years subsequent to its discovery and after the most productive years had passed. It also evidences the gradual falling off in yield, which has been nearly continuous since the richer portions of the deep channel of Lightning Creek has been worked over.

Similkameen, Rock Creek and Okanagan.

Having given in the preceding pages a somewhat full outline of the general mode of occurrence and working of the gold-placers of Cariboo, which are the most important in the Province, the remaining placer-mining regions must be very briefly noted, reference being made for such special particulars as appear to be of interest to the list of localities on subsequent pages. The general features of the various districts, though here given in connexion with placer-mining, may also be referred to in connexion with vein-mining in the same localities.

Physical
characteristics.

The Similkameen, Rock Creek and Okanagan region includes some of the first discoveries of gold in British Columbia, and has never since been entirely abandoned, though the amount of work carried on has fluctuated from year to year. This region stretches across the interior of the Province, and includes on one side streams rising in the inner flanks of the Coast Ranges; on the other, valleys which penetrate the western edge of the elevation of the Gold Ranges. The physical characteristics met with in this wide stretch of country are very varied, including mountains and plateau country with extensive wooded tracts penetrated with difficulty, but also some of the lowest, warmest and most arid valleys of the Province, like that of the Similkameen itself. The most notable portions of the region in respect to the occurrence of 'coarse' gold, of evidently local origin, are Granite Creek and Tulameen, Rock Creek and vicinity, Cherry Creek and Mission Creek. Elsewhere the gold is generally 'fine,' and is chiefly obtained from river-bars and flats, or from low benches. The most interesting features in the region are, the late resumption of gold mining

Localities of
coarse gold.

on a somewhat extensive scale on the Tulameen, the recent discovery (in 1885) of rich deposits of 'coarse' gold on Granite Creek, an inconspicuous stream, passed by hundreds of prospectors in early years; the transference of attention from the more or less completely exhausted placers of Rock Creek and Cherry Creek to the development of veins containing the precious metals, in the same vicinity, and the occurrence in very considerable quantities throughout the Similkameen district of platinum, alloyed with other related metals. On these points, further details are given elsewhere. It may be added here, that no part of this region is now so remote from means of communication as to cause serious difficulty in the development of any really rich metalliferous deposits, and the adoption, where circumstances warrant, of improved methods of placer-mining on a large scale.

No reasonably complete returns of the annual gold yield of the region here spoken of exist, in consequence of the desultory character of most of the mining, and the various channels by which the gold obtained found its way out of the country. Since the resumption of activity on the Upper Similkameen, consequent on the discovery of Granite Creek, the returns for that part of the region are given as below, in the reports of the Minister of Mines of British Columbia. Of the entire yield stated, Granite Creek itself has contributed \$383,000.—

1885.....	117,500
1886.....	203,000
1887.....	128,000
1888.....	105,000
Total.....	553,500

Kootanie and Big Bend.

Disregarding numerous less important and scattered localities of gold-mining, the remaining districts which have acquired celebrity from this point of view, align themselves, with that of Cariboo, on that member of the Cordillera system, which has been described under the name of the Gold Range. The Kootanie region, including under that general term the somewhat distinctly separated Big Bend country, extends from the International boundary north-westerly to the Great Bend of the Columbia, with a length of 246 miles. It is, for purposes of description, also regarded as including the adjacent western slopes of the Rocky Mountains proper. Wild Horse, Perry, French, McCullough and Carnes creeks may be mentioned as the most productive, though there are also many less noted localities, and a great number of streams which have as yet been little, if at all prospected, though

Principal
localities of
mining.

favourable in appearance. The mines of Wild Horse Creek have proved the richest in this region, though confined to about two miles in length along the valley of that stream. They were developed early in the history of gold-mining, and have ever since produced a considerable annual yield. Nearly all the other streams which enter the Columbia-Kootanie valley are known to hold more or less gold, and river-bars have been successfully worked along the Columbia and in places on the Kootanie. The discovery within the last few years of paying ground on Porcupine, Cañon and Quartz creeks, shows that the possibilities of this region for placer work are as yet by no means exhausted, and the resumption of work on Carnes, French and McCullough creeks, since the opening up of the country by the railway, bears similar evidence.

Physical
characteristics.

With the exception of some considerable tracts of fertile and partly open country along the lower valleys, the greater part of this region is extremely mountainous. It is generally well wooded, often bearing fine timber, but it is penetrated with difficulty, and much yet remains to be done in the way of prospecting before it can be considered to have been even fairly run over in search of placer mines. There is good evidence, in several places, of the existence of rich, deep ground in the valleys of creeks partly worked in former years, and some attention is also being paid to the initiation of hydraulic work on a considerable scale. The climate in the lower valleys enables a prolonged working season to be obtained on the placers. The rough character of the country, with the circumstance that neither the Columbia nor the Kootanie is continuously navigable, renders many parts of the region very difficult of access, and up to the time of the opening of the Canadian Pacific Railway, communication with it was almost entirely maintained from the south, a comparatively small portion of the gold yield finding its way to the banks in Victoria, and therefore not appearing in the returns, though it may be supposed to be covered by the amount allowed for as not recorded. The recent developments of vein-mining in this region are elsewhere alluded to.

Gold yield of
Kootanie
district.

The gold-yield from 1874 to 1888 from the Kootanie district (nominally including also the Big Bend country, though except in the later years covered by the return, no mining of consequence was actually in progress there) is given by the Minister of Mines of British Columbia, as below.—

1874.....	\$50,000
1875.....	41,890
1876.....	25,000
1877.....	37,000
1878.....	25,400

1879.....	19,000
1880.....	19,500
1881.....	25,000
1882.....	29,500
1883.....	29,100
1884.....	60,828
1885.....	76,650
1886.....	58,500
1887.....	37,900
1888.....	47,612

Omenica District.

Next in order, on the line of the auriferous axis of the Province, and separated from the last-mentioned region by a considerable interval in which no important gold-mining has yet occurred, is the Cariboo district, previously described.

Still further to the north-westward along the same belt, beyond an interval in which the Gold Range can scarcely be traced, is the Omenica district, first entered about 1864, but scarcely developed till 1867. This district is situated near the 56th parallel of latitude and is in the drainage-basin of Peace River. The area within which the greater part of the mining has taken place is scarcely more than fifty miles in greatest diameter, and includes the upper portions of Germanesen, Omenica and Mansen rivers and their tributaries. This area is described as being hilly rather than mountainous, and is nearly everywhere covered by the dense northern forest. A very high opinion was at first formed by miners of the Omenica district, but when the Cassiar discoveries occurred, it was nearly abandoned. In 1879, it was re-occupied by about fifty-seven Whites and twenty Chinese, and Vital, Germanesen, Mansen, Black Jack (a tributary of the last) Slate and most creeks were being worked; but the richer known localities having been since worked over, the mining has gradually dwindled to very small proportions. In 1887, only twelve Whites and about eighteen Indians are known to have been at work, and the gold produced is estimated at \$13,000. Much 'coarse' gold was obtained, but the diggings were generally complained of as being 'spotted' or irregular. This district is practically the most remote and inaccessible in the Province, the cost of supplies has always been excessive, and the difficulties in the way of enterprise in the form of exploration thus very great. A wide area of promising country in this region, therefore, remains neglected. The head-waters of Finlay River have always been considered particularly promising, from the fact that good 'prospects' of fine gold are found in all the river-bars, some of which have paid well for work.

Physical characteristics.

Mining.

Little prospected region.

on them. The sources of the Nation River have also been favourably spoken of, and the Misinchinca and other tributaries of the Parsnip, present all the appearance of gold-bearing streams, but so far as I know have never been tested. The 'fine' gold which is found and has been mined along the whole upper portion of the Peace River, has doubtless been carried through the mountains by that stream, and is derived from the wide belt of dark, shaly and schistose rocks which runs along the western flanks of the Rocky Mountains in this portion of their length.

Arquerite or
silver amalgam

Considerable quantities of arquerite, a silver amalgam containing about eleven per cent. of mercury, have been found with the gold in scales and nuggets, in Omenica, particularly upon Vital and Silver Creeks. This metal is commonly referred to by the miners as 'silver,' with which its appearance is identical (see p. 73 R). Very promising deposits of highly argentiferous galena have been found in the vicinity of the placer mines in Omenica, but no attempt has so far been made to work them. (See p. 73 R).

Routes to
Omenica.

The miners reached Omenica by two principal routes, viz., with pack-animals, by trail from Quesnel *via* Stuart Lake, and on foot across the Babine and Fire-pan Mountains from the Forks of the Skeena, the Forks being attained in the first place by ascending the Skeena from the coast in canoes.

Gold yield of
Omenica.

The gold-yield for the first and more prolific years of the Omenica district cannot be ascertained with any completeness, and even since the commencement of the annual government reports, a gap of three years occurs, no returns being given for 1876, 1877 and 1878. During these years, however, the field was virtually almost deserted. The following table is based on the government reports.—

1874.....	\$38,000
1875.....	32,040
1876.....	no return.
1877.....	"
1878.....	"
1879.....	36,000
1880.....	45,800
1881.....	39,300
1882.....	25,330
1883.....	21,000
1884.....	12,000
1885.....	16,500
1886.....	17,600
1887.....	13,000
1888.....	no return.

Cassiar.

The Cassiar district, includes the most northern region of gold-mining in British Columbia, and some of the creeks which have been worked lie to the north of the 60th parallel, or northern boundary of the Province. Dease Lake, lat. $58^{\circ} 30'$, long. 130° may be considered as the central point of the district. This lake is the source of the river of the same name, which is a tributary of the Liard, itself a branch of the Mackenzie. Gold had already been found and worked on the river-bars of the Stikine for eleven years, when Thibert and McCullough, coming from the east, reached and discovered the richer deposits of the Liard drainage-basin in 1872. The miners, who soon flocked into the district, came by way of the Stikine River, though a route for cattle and pack-animals was also opened overland from Fraser Lake. Dease, Thibert and McDame creeks and their tributaries have proved the richest, and a large quantity of gold has been obtained from them; though the yield has, of late years, become comparatively inconsiderable. The region presenting identical or analogous characters with that portion of it which has proved to contain these rich deposits, is very extensive, and much the same remarks which have been made in regard to the exploration of the Omenica district apply here also, though the cost of living in Cassiar has usually been somewhat more moderate. The country is generally wooded and mountainous, and difficult to traverse, but a waggon-road or even a railway, might without difficulty be constructed from the head of navigation on the Stikine to Dease Lake, and this will no doubt eventually be accomplished, as discoveries of veins containing the precious metals are confidently to be anticipated. Argentiferous galena has already been found, and the rough, unworn character of the gold on some of the creeks leads to the belief that its source might be ascertained without great difficulty. 'Coarse' gold is found locally on that part of the Stikine above Telegraph Creek, and the circumstances appear to indicate the existence there of an old channel, above the present river-level, but covered by massive flows of basalt of Tertiary age. (see p. 47 R.)

Difficulties have been encountered in this district from permanently frozen soil met with in mining, but when once the covering of forest and moss had been cleared off by fire these disappeared.*

The gold yield of the Cassiar District, from the commencement of mining to the present date, so far as known, is shewn in the following table, which, however, gives no returns for the earlier years of mining, when work was confined to the Stikine River.—

Chief localities
of mining.

Region to be
prospected.

Frozen soil.

Gold yield of
Cassiar.

* For further particulars on the Cassiar Region see Annual Report Geol. Survey, 1887. Part B.

1873.....	Not known.
1874.....	\$1,000,000
1875.....	830,000
1876.....	556,474
1877.....	499,830
1878.....	519,720
1879.....	405,200
1880.....	297,850
1881.....	198,900
1882.....	182,800
1883.....	119,000
1884.....	101,600
1885.....	50,600
1886.....	63,610
1887.....	60,485
1888.....	43,325
Total.....	4,929,394

Yukon District.

Great length
of auriferous
rivers.

This extensive region, situated to the north of the 60th parallel, and west of the main range of the Rocky Mountains, lies beyond the northern boundary of British Columbia, but in the continuation of the same metalliferous Cordillera belt, and is therefore naturally included in connexion with the Province. Gold-mining began here only in 1880, and so far has been chiefly confined to river-bar work, nearly all the long streams tributary to the Yukon having proved to yield more or less 'fine' gold. The aggregate length of rivers upon which gold has already been found is almost unprecedented, and the field for prospecting in search of richer deposits of 'coarse' gold is very extensive. So far the only discovery and mining of 'coarse' gold has been upon Forty-mile Creek, in lat. 64° 30'. The country is wooded and in general not extremely mountainous, and the rivers afford a means of travel in summer, though usually swift. Access to the country is, however, difficult, being generally obtained by way of the Chilkoot Pass which crosses the continuation of the Coast Ranges at the head of Lynn Canal.*

Skeena River.

Gold yield of
Skeena.

On the Skeena River, which reaches the Pacific near the northern end of the coast-line of British Columbia, placer-mining has been carried on to a limited extent during the past few years. Lorne Creek is the most important auriferous locality, but gold has been found in

* For further particulars on this region see Annual Report Geol. Survey, 1887, Part B.

several other creeks and gulches in the same vicinity. These are easily reached by canoe from the coast. The yield of gold, chiefly from Lorne Creek, is reported as follows.—

1884.....	\$17,000
1885.....	18,000
1886.....	13,400
1887.....	5,280
1888.....	no return.

Vancouver Island.

In Vancouver Island, the only placer mining district of importance which has been worked, is that of Leech River, some particulars relating to which will be found on page 141 R.

GENERAL CONSIDERATIONS RESPECTING PLACER GOLD-MINING.

Though the yield of the gold-placers of British Columbia is now very much less than it was at one time, and shows at present a gradual decrease, placer-mining still contributes substantially toward the prosperity of the Province, and employs a considerable number of men. It is, moreover, to be anticipated that this form of mining may continue to be a feature in the industries of the Province for many years to come, and it is quite possible that circumstances may occur which shall bring about a notable revival of mining of this kind. Elsewhere it is commonly observed that placer-mining has been the first step toward vein-mining, not alone indirectly from the fact that the placer work has drawn a population to the metalliferous regions, but also directly by the actual tracing up of the gold first found in the alluviums to its original matrix. We cannot therefore afford to set this class of mining aside as a dead issue.

The future of placer-mining deserves consideration, particularly from the following points of view :—

1. In each proved auriferous district, the poorer or less concentrated gold-bearing ground must necessarily greatly surpass in area that of the very rich deposits which alone pay for work with primitive appliances and with the cost of supplies and labour at high figures. Thus the cheapening of these essentials, produced by improved means of communication and by the settlement of the country, coupled with the attendant facilities for bringing heavier machinery and appliances into use, will enable the profitable working of greatly extended areas. These considerations apply particularly at the present time to the region of country in the vicinity of the railway or connected with it by

Future of
placer-mining.

Respective
areas of rich
and poor
ground.

allel, and
eyond the
on of the
included
e only in
nearly all
ield more
hich gold
for pros-
extensive.
een upon
d in gene-
s of travel
however,
ass which
of Lynn

northern
has been
orne Creek
found in
rt B.

easily travelled routes. By the construction of the railway a large part of the Kootanie district, together with that bordering upon the lower part of the Fraser, has been opened up for work of this kind, and deserve particular attention. The hydraulic method of mining will doubtless rank first among the means to be brought into use for the utilization of the poorer deposits. From this point of view, the railway has also, to some extent, changed the conditions in the Similkameen and Rock Creek country, and in the Cariboo district. It has effected no change in regard to the Cassiar district, but as already noted, this district may, without great cost, be rendered easily approachable from the coast. The difficulties remain greatest with respect to the Omenica district, and a number of outlying places of less importance.

Further
prosecution of
placer-mining
in known
localities.

2. Another point deserving consideration, is the further exploration of the already known rich deposits of gold confined principally to the old buried channels of the streams. In reviewing the experience already obtained in working these, we notice, in a majority of cases, that it has so far been found possible to work lengths of from one to three miles of these old channels only, and while, in some instances, it appears that the rich ground is not more extensive, in many there is good reason to believe that much more remains, capable of yielding good returns, but which it has been found impossible to get at with the appliances and means at command. There are also quite a number of valleys in which, though the bed of the present stream has proved rich, the deep ground or old channel has not even yet been reached, or if reached, has not been satisfactorily tested. In all these cases it requires only more effective machinery and greater engineering skill to be brought to bear, to attain and work the deposits referred to, and it is likely that many of them will pay well when such means can be applied at a reasonable cost. It is not improbable, for instance, that thus treated, such localities as Williams Lightning, Cunningham and Antler creeks in Cariboo might be found to yield great additional amounts of gold, and whenever railway communication is provided for the Cariboo district, they will at least be thoroughly tested. Other methods involving extensive works with the same object, such as the damming or diversion of streams, and the construction of long, bed-rock flumes or drainage adits, fall under the same head, and there can be no doubt that extensive works of this character will eventually be undertaken in the Province with satisfactory results.

New
discoveries.

3. The discovery of important new gold-bearing creeks is still to be anticipated from time to time. The small portions of the lengths of individual streams which have been found to contain great quantities of gold, is alone sufficient to show how easily such localities may be

missed or passed over in a rough mountainous country of great extent. Granite Creek and Coyoonh Creek afford definite cases of this kind, the first discovered only in 1885, the second in 1886, and both in parts of the country which have been more or less thoroughly over-run by armies of prospectors for the past twenty-five years. The tracts which have been slightly or scarcely at all examined, even those situated on the line of the auriferous range, are very extensive, and in the Yukon district, to the north of British Columbia, the prospects for discovery of this kind appear to be 'most favourable, and are still almost limitless.

4. Not the least important consideration, however, from the point of view of placer-mining, is that of the probable existence of placer deposits differing in age and character from those which have so far been worked in the Province. The rich deep leads of Cariboo evidently date from a period antecedent to that in which the country was for a time covered by a great ice-mass, or are, in other words, pre-glacial, and lie beneath the boulder-clay and other deposits due to the 'ice age.' The wearing down of the country-rock and natural concentration of gold had been in progress from the close of the Miocene or Middle Tertiary period (or perhaps in some localities even from an earlier date) to the glacial period. During the period of the Middle Tertiary, a great part of the Province included between the Coast Ranges and Gold Range became occupied by fresh-water lakes. These covered and by degrees filled up with their fine sediments, whole systems of drainage which had been produced during early Tertiary time; and into the lakes themselves, during the period of their existence, streams from the surrounding mountain regions discharged, forming gravel-beds, which are particularly abundant at the base of the finer deposits. Toward the close of the Middle Tertiary, extensive volcanic action occurred, producing the basalts and other igneous rocks which still overlie the greater part of the area of the old Tertiary lakes. Denudation which has gone on since this time, has locally removed considerable portions of these Middle Tertiary deposits, and has cut new valleys in them, and there

Probable
existence of
older placers.

Character of
Tertiary
deposits and
Tertiary
placers.

Modern placers

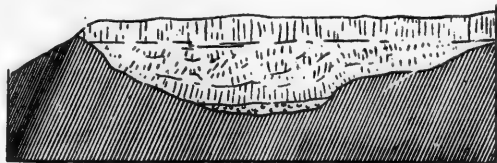


Fig. 2. Section on the Stikine River, above Telegraph Creek, shewing basalts filling a pre-Miocene valley and overlying the old river-gravels. From Annual Report Geol. Surv. Can., 1887, p. 71 B.

is reason to believe that some of the modern placer deposits have been enriched more by the robbing of these old, early and Middle Tertiary gravels than directly from the wearing down of the original rocks.

Places where
ancient placers
may be found.

Whenever, therefore, these old Tertiary gravel-beds or conglomerates exist in the vicinity of the known auriferous districts, they well deserve careful examination, though, so far as I am aware, none of them have actually been worked as yet in the Province. In such localities for example as Mission Creek, the South Similkameen and Whip-saw Creek, recent auriferous gravels rest upon the worn surface of Middle Tertiary rocks, consisting of soft argillites, shales and sandstones. These rocks are generally known to the miners as 'false bed-rock,' and it is highly probable that if they were sunk through to the bottoms of the still older valleys in which they lie, rich gold-bearing gravels or conglomerates might be found.

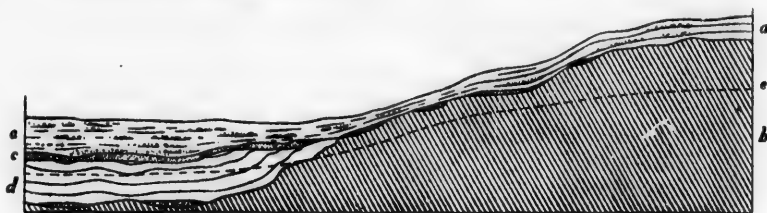


Fig. 3. Diagram representing mode of occurrence of gold on Mission Creek. a. Recent gravels. b. Crystalline rocks. c. Auriferous gravel. d. Tertiary beds, shewing the possible occurrence of underlying Tertiary placer-deposits. e. Line representing present bed of stream. From Report of Progress, Geol. Surv. Can., 1877-78, p. 157 B.

Mission Creek. The accompanying section, reprinted from my report of 1877-78, illustrates the known mode of occurrence of gold on Mission Creek and the possible existence of old Tertiary gravels in that vicinity.

Probability
of Cretaceous
placers.

It is further probable that gravels dating from periods still earlier than the Tertiary, and now consolidated into conglomerates of varying degrees of induration, may be found to contain gold in remunerative quantity. Allusion has already been made in this connexion to the Cretaceous conglomerates of the Lower Fraser (p. 29 B), and similar conglomerates are also known to occur in great mass near Tatlayoco Lake and the head-waters of Bridge River, on the Quesnel River, and elsewhere. It may in fact be affirmed, that all gravel-beds or conglomerates of whatever age, occurring in or near the auriferous regions, are worth examination for gold, and particularly so when they are found directly in contact with the surface of the still older rocks which constituted the 'bed-rock' at the time of their formation.

Fig. 4. Section of gold-placers in these have been formed by erosion. X, p. 408.

The gravels and conglomerate deposits of the Middle Tertiary, often bear a distinct relation to the modern valleys in the more mountainous districts, in which the main outlines of erosion have been nearly constant from a very early period, but in the wider and lower parts of the Interior Plateau, great areas are covered by nearly horizontal flows of basalt, beneath which, should old auriferous stream-beds exist, they can only be traced by underground work or by boring, in the manner adopted at Ballarat and elsewhere in Australia and in some places in California. Since the period of deposition of the still older Cretaceous conglomerates, the surface of the country has suffered so many changes, including among others the elevation of the Coast Ranges, that these conglomerates now bear little or no relation to the present drainage systems.

Relation of
placers of
different
periods to
physical
features.

The considerations above stated are not merely of a theoretical character, but are warranted by experience gained in other regions. The old buried placers of California (which Prof. Whitney believes to have been in process of formation by erosion continued throughout nearly the entire Tertiary period), and those of Australia, are so well known to most gold-miners as to require no more than mention. It is not so generally known, however, that conglomerates of Carboniferous and of Carbonifero-Permian age have been worked for gold in New-South-Wales, and in Queensland (as at Peak Downs) and that gold in greater or less quantity has been found in conglomerates of the Carboniferous period in Nova Scotia (at Gay's River), and in France. Of still greater interest, in the same connexion, is the existence of gold in the Potsdam conglomerates of the Black Hills in Dakota, where these rest upon the surface of certain still older schistose rocks which contain auriferous quartz-veins. Regular mining operations have been conducted in these conglomerates, and they have been found to be, locally, extremely rich. Mr. Jonny states that there are four distinct ages of

Instances of
ancient placer
deposits.



Legend: Schist. — Cement Mines. Porphyry. Potsdam.

Fig. 4. Section in the Black Hills, Dakota, shewing the mode of occurrence there of ancient gold-placers in conglomerates at the base of the Potsdam sandstones, and the manner in which these have served as a source of supply of gold for newer placer-deposits in valleys subsequently formed by erosion. From paper by W. B. Devereux in Trans. Am. Assn. Mining Engineers, Vol. X, p. 468.

gravel formations in the Black Hills:—(1.) Potsdam, (2.) close of Tertiary, (3.) close of Glacial period, (4.) recent, and that all of these have proved to be auriferous, except the third. The accompanying section will illustrate the mode of occurrence of the 'fossil placers' of the Potsdam in the Black Hills, and the formation of recent placers secondarily from these, better than any description.

The auriferous Potsdam conglomerates are very compact, and require to be milled and treated like auriferous quartz, and the same may be said with respect to some of the old conglomerates or 'cements' of Victoria and of New Zealand. Some of those in Victoria are, however, stated to have yielded an average of twelve ounces of gold to the ton.*

CONNEXION OF PLACER-MINING AND VEIN-MINING.

Intimate relation of placers and gold-ores.

The transition from placer-mining to 'quartz-mining' is an easy one. The richer and more easily reached placers are, as a rule, soon worked over, and it then becomes natural to enquire as to the sources of these old concentrations. The consequent change of the centre of interest has already occurred in most parts of California and in Australia, but British Columbia is still in the transition stage in respect to mining. Save in a few exceptional cases, the occurrence of 'coarse' or 'heavy' gold in the old channels, may safely be accepted as proving that the original source of the gold is not far off. The distance to which 'coarse' gold travels is, as a rule, very inconsiderable, even in the beds of rapid streams. Additional evidence to the same effect is generally afforded by the varying assay value of the gold found on different creeks or even on different parts of the same creek, and this is often emphasized by the rough unworn character of the gold and the circumstance that it not unfrequently still holds imbedded fragments of quartz. It is from this point of view in particular, that it is most important to note and preserve a record of the observations made by the placer-miners in the course of their work, even where the deposits do not any longer continue to be remunerative.

Conditions in California.

Speaking of broad areas in California and Australia, where work of both kinds is in progress, it may be affirmed that the rich placer districts coincide with the rich quartz districts throughout. Innumerable special cases might be cited, if it were necessary, to shew the exceptionally rich local deposits of placer-gold depend on the occurrence of notably rich quartz-veins in immediate and clear relation to them, and in the fact that extremely rich localized placers have been found

* See, in this connexion, Ore Deposits, J. A. Phillips, pp. 232, 459, 508, 602; Mineral Wealth of Queensland, 1888, p. 25; American Inst. of Mining Engineers, vol. x, p. 466; U. S. Tenth Census, vol. xiii, p. 90.

in many parts of British Columbia, and particularly in the Cariboo district, we find justification for the belief in the future of 'quartz-mining.' It is true, that in some instances the natural concentration of the gold derived from the wearing away of a great mass of comparatively poor rock, may give rise to rich placer deposits, or that the veins from which the gold has been derived may be too irregular in richness, or too much broken, to be profitably worked themselves; but those exceptions cannot be regarded as negating the general rule. The fact remains that a large proportion of the mines of precious metals in California and in Australia have been discovered by tracing the placer deposits of gold to their sources. Placer deposits derived from the Comstock lode were worked for ten years before the lode itself was discovered, and when found and opened, it proved to be essentially a great silver mine in which gold occurred in relatively small quantity. In the same way, the working of placer deposits preceded the discovery of the now celebrated Treadwell mine in Alaska, and the 'propector' is justified in following up this clue wherever he can find it.

Placer deposits
indicative of
auriferous
quartz.

GENERAL REMARKS ON VEIN-MINING.—(*Precious Metals*.)

Gold.

The conditions of occurrence of workable auriferous lodes in British Columbia, yet remain to be studied in detail and discovered as the development of mining of this kind progresses. It may, however, be stated from what is already known, that while not confined to rocks of this class, the more important gold occurrences are usually found in connexion with areas of argillite-shales and schists, commonly of dark colours, and often more or less distinctly carbonaceous. Further, that only in certain parts of the extent of these argillite rocks have really rich placer deposits been found, a fact depending apparently on the occurrence locally of quartz-veins traversing them, and also, possibly, on the existence of igneous intrusions or other peculiar circumstances, which remain to be ascertained. So far as these generalizations go, they correspond with those already arrived at in California, saving that in British Columbia the argillaceous and schistose belts referred to, appear to belong to several geological horizons widely separated in date of formation, as already noted. The accessory local causes which have resulted in the deposit of gold in veins, etc., appear to be found most frequently in and near the Gold Ranges.

Occurrence of
gold in British
Columbia.

Comparison
with California

While it is not possible here, even if it were necessary, to enter into any general discussion of the features and principles of the mining and treatment of ores of the precious metals, it may be useful to those now

interested in the discovery and development of such deposits in the Province, to note very briefly a few important points bearing on this subject and dependent on recent investigations.

Tendency of recent mining.

As showing the general tendency of recent mining, and for the purpose of directing attention to the larger deposits of low-grade ores, I can not do better than quote the following judicious remarks of Mr. Clarence King, who writes:—"It may be said that the richer and purer ores which were sought for in the early days of mining, have been gradually giving way to those of more complicated nature and generally of lower value in the precious metals. Consequently in the reduction processes we find smelting acquiring a relatively more important place than it formerly held, and in milling an increasing use of dry crushing processes connected with subsequent roasting of the ore, and a marked growth of the lixiviation process."*

Low grade gold-ores.

A particular instance of the treatment of low grade gold-ore occurring in great mass, of special interest to British Columbia on account of its proximity, is afforded by the Treadwell mine in Alaska; the profitable working of which, upon a large scale, is rendered possible only by the great advance in modern appliances and methods of treatment. Further important evidence to the same effect is afforded by the results of recent mining in Australia and in the United States. From the Government Mineral Statistics of Victoria for 1887,† we learn that the average yield per ton in that year was 9 dwt. 9·95 grains only of gold, (0·471 oz.) the quantity of quartz treated being 780,733 tons, while the Ballarat district, one of the most important, yielded an average of only 7 dwt. 23·57 grains (0·399 oz.). Since the first publication of mineral statistics in Victoria, particulars have been obtained respecting 23,386,935 tons of quartz, the yield of gold from which averaged 10 dwt. 11·09 grains (0·523 oz.). The cost per ton for crushing alone, varied, in 1887, from 15s. to 4s. 6d.

Australia.

California.

In certain localities in California, where the ore can be quarried rather than mined, under specially favourable circumstances, gold-bearing quartz yielding as little as \$1 to the ton is reported to have been profitably worked.

Dakota.

For the purpose of further illustrating the class of gold-ores which may be worked with profit, the following tabular statement representing certain well known and largely productive mines in California and in the Black Hills of Dakota, has been compiled. The first four mines yield free-milling ores, the last a sulphuret ore with only a certain proportion of free gold.‡ The figures for the two first mines and the fourth refer to the year 1885. Those for the third to 1884-85, and those for the fifth represent the average work for four years, 1881-84.

* U. S. Tenth Census, vol. xiii., p. xii.

† Mineral Statistics of Victoria for the year 1887. These figures refer to the ton of 2,240 lbs.

‡ See Hamilton Smith in Mining Journal, London, 1886, vol. lvi, part 2, p. 267, and T. G. Canning, in Engineering and Mining Journal, N.Y., 1886, vol. xiii, p. 419.

MINE.	Quantity of ore treated.	Mining.	Milling.	Management, etc.	Total cost.	Total yield.	Prof.
	Tons.	\$	\$	\$	\$	\$	\$
Sierra Buttes, Cal.	54,479	4.06	0.56	1.21	5.83	6.98	1.15
Plumas Eureka, Cal.	56,052	4.36	0.61	0.60	5.57	7.60	2.03
Homestake, Dak.	213,190	Total cost per ton, mining, milling, etc. .			3.25	5.73	2.48
Father de Smet, Dak.	106,855	"	"	"	2.12	3.57	1.45
Elaho Mine, Grass Val., Cal.	...	Average cost of mining, milling, etc.			8.97	18.59	9.62

It is of great interest further to observe, as the result of discoveries and investigations made within the last few years, that in endeavouring to trace out the sources of placer-gold and discover workable gold-ores, attention should not be too exclusively given to quartz-veins alone. While the greater part of the known gold-ores belong to the class of quartz-veins, it is now found that gold occurs also in payable quantity in many other associations.

It has long been recognized that certain belts of rocks containing numerous small and irregular quartz stringers only, will pay for mining and crushing as a whole, and where, as in Cariboo, there is reason to believe that the larger known veins can scarcely be looked upon as the true sources of the 'coarse' gold of the placers, such quartzose belts of country-rock may well be sought for and tested. In Queensland, Victoria and New-South-Wales, Mr. Daintree and others have been able to prove, not only that there is an association between the paying quartz-veins and the vicinity of the occurrence of certain intrusive igneous rocks, but also that in these intrusive rocks and notably in certain pyritous diorites, gold occurs in some instances in such quantity as to have produced paying placers by their decomposition. Similarly, in Colorado, between South Park and Blue River, Prof. J. J. Stephen-son describes certain dykes of compact trachyte and Silurian and Carboniferous quartzites as the sources of the placer gold which has been extensively worked there, though not themselves containing gold in payable quantity.

In further evidence of the wide distribution of gold, it may be added, that in North Carolina, Prof. W. C. Kerr notes the following rocks as being there auriferous. In Morse County, a mine which yields its gold mainly from felspathic schist. In the famous King's Mountain mine the gold is obtained not only from certain seams of quartz, but also from a sixty-foot bed of schistose limestone, which is quarried out bodily and sent to the stamps. Gold is also found in paying quantities in quartzite-schist and quartz-slate, and in "grey much jointed quartzites and felsites of the Huronian hills on the eastern side of the

Gold-ores of various kinds other than quartz.

Peculiar occurrences of gold. Queensland.

Colorado.

North Carolina.

great slate belt" of North Carolina. From these facts Prof. Kerr is led to conclude that, "gold is so widely diffused that we may expect to find it in any kind of rock."

Mount Morgan
deposits.

The Mount Morgan gold deposit of Queensland, which is the most important recently discovered, illustrates still another peculiar occurrence of exceptionally rich gold-ore. The gold is here found minutely disseminated in a mass of brown and red hematite and siliceous sinter, which has apparently been produced by a former thermal and geyser-like spring. The gold-content of this material is no less than about seven ounces to the ton and at present 1500 tons a week are treated. Fragments of richly auriferous rock resembling that of Mount Morgan have been found at Clinton, in British Columbia, but have not yet been traced to their source.

Treadwell
Mine, Alaska.

I am not aware that any systematic description has yet been published of the Treadwell mine of Douglas Island, Alaska, but from an examination of it which I was able to make in 1887, I may say that the rock there worked appears to be nothing more than an upper part or edge of a great granitic dyke or intrusion, which has broken through the black, slaty argillites of the region, and has been subjected to extensive hydrothermal action, produced either by emanations from the granite mass itself, consequent on its relief from pressure on approaching the surface, or subsequently to the intrusion of the granitoid rock by independent agency. This action, however brought about, has entirely decomposed whatever mica or hornblende the rock may have originally contained. It has also, to a great extent, decomposed the feldspars and has charged the whole mass with quartz of secondary origin, which sometimes takes the form of minute stringers, but more generally spreads itself uniformly in the decomposed rock-material, and is associated with small crystals of auriferous iron pyrites and minute quantities of free gold. The same hydrothermal action which has caused the decomposition of the edge of the granitic intrusion, has evidently produced the quartz-veins found to penetrate the adjacent slaty rocks; which veins, in the neighboring "Silver Bow Basin," are found to hold gold in distinctly visible particles and small nuggets. The rock-formations met with on the part of the Alaskan coast where this mine is situated, being identical with those of the coast region of British Columbia, to the southward, it becomes important that all similar contacts of rusty or pyritous granitoid rocks with the argillites, should be examined and assayed, as it is not improbable that further deposits of the character of the Treadwell mine yet remain to be discovered there.*

* On peculiar modes of occurrence of gold referred to in the preceding pages, consult Ore Deposits, J. A. Phillips; Quart. Journ. Geol. Soc., vols. xxviii, p. 271, xxxiv, p. 431; U.S. Geographical Survey west of the 100th meridian, vol. iii, p. 423; Trans. Am. Inst. of Mining Engineers, vol. x, pp. 340, 475; Mount Morgan Gold Fields, 1884; Mount Morgan Gold Deposits, Second Report, 1886, R. L. Jack, Queensland, Government; Mineral wealth of Queensland, 1886.

Silver.

Respecting silver-ores in the province of British Columbia, it may be stated, as the result particularly of the developments of the past two years, that these appear likely to achieve importance even before those which are distinctively auriferous. There is every reason to believe that before many years elapse the Province will take its place as one of the great silver producing regions of the world, and it is possible that silver may attain and continue to hold a greater importance than gold.

Characteristically silver-bearing ores have already been found in numerous widely scattered localities. The greater number of these, however, arrange themselves along the metalliferous belt which has already been referred to as that upon which the most important placer-deposits of gold occur. Argentiferous galenas appear to be the most abundant ores, and the knowledge of these already attained is sufficient to enable us to trace this silver-bearing belt, from point to point, from the International boundary north-westward to the 60th parallel of latitude (forming the northern boundary of the Province) and beyond it to Forty-mile Creek, where the Yukon leaves the North-west Territory to enter Alaska. The belt thus defined has the almost unexampled linear extent of about 1200 miles, and it may be said that wherever it has been explored and prospected (which has occurred generally in connexion with work on gold-placers), highly argentiferous galena ores have been found.

The most considerable discoveries so far made, however, are those in the southern part of the belt, and for the most part at no great distance from the Canadian Pacific Railway. These deposits, it is fair to assume, have been brought to light on account of the accessibility of the region in which they occur; for nothing is known to show that other parts of the same belt of country, when similarly brought within reach and examined, may not prove to be at least equally rich in such ores. Even in the district in which discoveries and development are now being actively pushed at several centres, there is reason to believe that what has become known, bears but a small proportion to that which remains to be found; for by far the greater part of this rough mountainous country is still unexplored, or has been traversed only along certain routes, between which are wide, untrodden and often densely forested and rugged tracts. Thus, from every point of view, the discoveries made within a very short time in this southern portion of the metalliferous belt, must be considered as of the most encouraging character.

Definition of
chief silver-
bearing belt.

Discoveries in
southern
British
Columbia.

Modes of
treating silver-
ores and
expense.

The principal modes of treating the various classes of silver-ores, depending on their composition, may be summarized as below :—*

Free silver, decomposed argentiferous ores or chloride minerals : Treated by free silver milling.

Silver ore, accompanied by sulphides of copper or other base metals : Low grade, fine concentration ; high grades, roasting milling.

Argentiferous copper- or lead-ores : Coarse concentration and smelting.

A large proportion of the ores found up to the present time in British Columbia, including nearly all those of the Kootanie region, belong to the last-noted class. The expense of treating such ores must vary very materially according to the cost of labour, fuel, etc., but may run from \$15 to \$25 a ton, and this the price of the metals in the ore must be sufficient to cover after all the cost of mining, concentration and transport to the smelter have been charged against them.

VEIN-MINING DISTRICTS (*Precious Metals*).

Classification of
ore-deposits.

Under this heading, it is proposed to give a few particulars relating to the various districts which have already attracted some notice on account of the occurrence of veins containing gold and silver. Some of the deposits mentioned might with equal propriety be classed as lead-ores or copper-ores, but when these contain the precious metals in workable quantity, it becomes more convenient to include them here. As it is difficult to follow any regular geographical order, the Cariboo district, as being that in which the earliest attempts at 'quartz-mining' have been made, is placed first.

Cariboo.

History of
'quartz-
mining.'

The general features of the Cariboo mining region, have already been referred to in connexion with its placer mines. Almost from the first working of the placers, the existence of numerous quartz-veins was noticed, but no particular attention was given to these till the yield of alluvial gold began to be notably diminished. It was then felt, that notwithstanding the remoteness of this district, the existence of settlement and of a considerable mining population in it, justified the attempt to develop 'quartz-mining.' This feeling brought about the premature quartz excitement of 1877 and 1878, which was based on exaggerated ideas of the richness of certain known lodes, and on erroneous views as to the facility with which gold might be extracted from the pyritous ores which these afforded. From the collapse of this

* From the Mining Journal, vol. lix., p. 278.

* Report of

excitement, vein-mining received a severe check, but in spite of this discouragement, the miners of Cariboo have not relaxed their efforts toward the development of vein-mining, their attention being, as is only natural, almost entirely directed to gold-bearing quartz.

From what is known of the district, I can entertain no doubt that it is destined to become an important vein-mining one. It has been made clear that in that part of the district in the immediate vicinity of the rich placers, there exists a great number of well-defined quartz-veins, and while such small tests as have so far been made, shew that a majority of these yield low returns in gold, some are already known to afford encouraging results, such as to warrant extensive working if the region were better provided with means of access.

The explorations of the miners have been assisted by the work (in 1885 and 1886) of Mr. Amos Bowman, of the Geological Survey. In a preliminary report already published* Mr. Bowman enumerates nearly a hundred ledges and 'quartz prospects' visited by him, adding that these do not comprise probably half the number noted or a hundredth part of the really good ledges which a prospector might find in the Cariboo country. These places are described in greater detail in his forthcoming report on the district. Notwithstanding the absence of railway communication, the prospects of the establishment of an important 'quartz-mining' industry in Cariboo were never so bright as at the present moment.

It is, of course, impossible to mention here all the very numerous localities in which ledges have been located or noted, or even to specify those upon which more or less prospecting and exploratory work has been done. These details will find a place in Mr. Bowman's forthcoming report. It may be stated, however, that Mr. Bowman considers the following groups or series of ledges as among the more promising ones known up to the present time, and apparently worthy of special attention:—

Ledges between Island Mountain and Mosquito Creek, extending two miles. (Including "Walker," "Sadou," and "St. John's" or "Island Mountain.")

Ledges near Williams Creek, from Lowhee divide to Proserpine Mountain, extending one mile and a half. (Including "Proserpine," "Stedman," "Big Bonanza," "Enterprise," "Victoria," and "Sam Crane.")

Ledges at Burns' Mountain, Lightning Creek, extending half a mile. (Including "Perkins," "Burns' Mountain," and some of the Lightning Creek ledges.)

Ledges crossing Grouse Creek. (Including "Dufferin" and "Fountain-head.")

* Report of Minister of Mines of British Columbia, 1886.

Ledges on Snow-shoe Plateau from Break-neck divide to French Snow-shoe Creek, extending about two miles and a half. (Including "Haywood" and "Arastra".)

Ledges crossing Hixon and Cañon Creeks. (Including "Washburne," "Stewart" and "Morrison.")

Table of assays Reference should also be made to the assays from various veins given elsewhere. (See p. 76 R.)

Transition from placer- to vein-mining.

While it is conceivable that extremely rich placer deposits, like some of those of the Cariboo District, might be produced by the wearing down and natural concentration of great masses of rock, through which gold may have been very thinly scattered, or in which the gold occurs merely in small and irregular quartz stringers, there is no probability that such conditions are universal in the Cariboo district. The very 'coarse' character of much of the placer gold and the definite localization of the richer parts of the deposits here, shew that these must often be near their points of origin, and the problem now before the miner is that of ascertaining the sources of the gold, and discovering the rules locally applicable to the original deposits.

Points to be considered.

In connexion with this problem in Cariboo, I would invite attention specially to the points alluded to in the general remarks on vein-mining (p. 53 R) for the purpose of inducing an enlargement of the scope of the enquiry. It may also be mentioned that the very fact of the 'coarse' character of much of the Cariboo gold, goes to shew that while gold may exist as well in paying quantities in a finely disseminated state, much of it must evidently occur very irregularly in the productive ledges, from which it may, therefore, be necessary to obtain the average of a large quantity of rock before a conclusive test can be said to have been made. The existence of 'pay chutes' is a fact familiar to all miners, and has been found notably to characterize gold lodes in both California and Australia. Such chutes may form but a small portion of the natural outcrop of the veins, an additional circumstance calling for trials of lodes on a somewhat extensive scale before they can be affirmed to have been fully proved.

Relation of sulphurets to gold.

In the Californian gold belt, according to Mr. G. F. Becker, so general is the association of gold with sulphurets, that where gold is not visible, miners, judge of the value of an ore by the quantity of sulphurets it contains. Mr. Becker adds:—"Quartz with plenty of sulphurets and no visible gold often occurs in large bodies, and is apt to pay better in the long run than quartz with very coarse gold, or 'specimen quartz,' as it is called by the miners."* While this rule seems to hold also to a considerable extent in Cariboo, particularly in the association of gold in veins with iron-pyrites, it would appear, so

* U. S. 10th Census, vol. xiii, p. 10.

far as experience has gone, that it is either not so constantly the case, or that the proportion of gold in the pyrites is less considerable than in the gold belt of California. This and other similar points are, however, only to be settled by exploratory work and by working tests, and as several very strong pyritous lodes are already among those best known, it will probably not be long before their character is fully ascertained.

With the object of encouraging such trials, the government of British Columbia has erected a test-mill, near Barkerville, which is at the present time nearly ready for work. There are also already in the same vicinity four small stamp-mills.

Kootanie.

This region includes the Selkirk and Purcell ranges and adjacent western slopes of the Rocky Mountains proper. It may be conveniently divided, for purposes of description, into West and East Kootanie, the line of separation following approximately the watershed between the two arms of the Columbia River.

Since the Selkirk Mountains have been traversed by the Canadian Pacific Railway, and have thus been rendered accessible, and a means ^{Recent development of} rich ores. afforded for the shipment of ores, very active prospecting has been carried on in a number of localities, and has resulted in the discovery of numerous deposits of rich ores, principally silver-bearing. This region is, at the present moment, that in which the interest of mining men is chiefly centred, and the developments so far made,—though but in their initiatory stages,—are of the most promising kind. The summer of 1889 will no doubt witness great activity in this entire region, and it is confidently expected that before the autumn the first really considerable shipments of silver-ores will have been made, and the reputation of the region as an argentiferous one well established. Though not in a position to speak from personal investigation of the localities which have quite recently sprung into notice here, I am indebted to Messrs. G. M. Sproat and A. W. Vowell, Gold Commissioners, and to Mr. G. B. Wright, for a number of particulars, upon which and on such other information as is available, the following brief notices are based:—

West Kootanie.—

The principal metalliferous belt which has so far attracted attention in this region, is believed to extend along the western slope of the mountains, with a width of about twenty miles and a general course slightly to the west of north, from a point six or eight miles south of the outlet of Kootanie Lake, nearly to the Big Bend of the ^{Chief metalliferous belt.}

Columbia, where the Selkirks, as a distinct range, seem to terminate somewhat abruptly. The localities on this metalliferous belt which require special notice, are, in order from south to north, *Toad Mountain Mining Camp*,* with silver and gold ores; *Hot Springs* and *Hendryx Camps*, with silver-ores and lead; *Illecillewaet*, with silver and lead ores; and the *Big Bend region*, apparently characterized principally by gold-bearing quartz.

Toad Mountain *Toad Mountain Camp*.—The centre of the group of metalliferous deposits included under this name, is situated about four miles and a half south-west of the outlet of Kootanie Lake, some forty miles north of the International boundary, at an elevation of about 3900 feet above the lake, or approximately 5700 feet above sea-level. The deposits

Silver ores. were discovered in the autumn of 1886. They occur principally in a belt of calcareous rock (called by the miners a lime-shale), which is said to be bounded on both sides by granite. This belt has a width of a little less than a mile, and has already been imperfectly prospected for a length of five or six miles. The course of the metalliferous belt is nearly east-and-west, running along the northern slope of the high, southern mountain-wall of the valley of the Kootanie River. The silver-bearing lodes are, however, not strictly limited to the above described belt, but have been found also in various places several miles removed from it. The claims registered in and near the Toad Mountain Camp numbered on the first of August last 228. The deepest shaft at that time did not exceed seventy-five feet, and most of the shafts or tunnels were much less than this in depth or length. The most prominent claims at the present time appear to be those in the Hall Brothers group, the "Silver King," "Kootanie Bonanza" and "American Flag."

"Silver King." The first-named is that upon which the largest amount of work has been done. The outcrop of the vein here showed an apparent width of about twenty feet, but is reduced to a width of from six inches to four feet, at the depth to which it is now opened. There are no well-defined walls, the ore being apparently incorporated closely with the country-rock. The ore is said to consist of copper-stained iron-ore, peacock copper, copper-pyrites and tetrahedrite, with streaks of what the miners term 'brittle silver,' and is often very rich. Assays of choice specimens are said frequently to run from 100 to 1700 ounces of silver to the ton. I have seen the returns of a trial shipment of twenty-two tons of ore, sent for treatment to Montana, which yielded \$6463, chiefly in silver. The ore was hand-picked, but not otherwise concentrated. It was divided into two lots, which assayed respectively:—

Trial shipment made.

* The expression "mining camp" is here used in its western sense, as a convenient and generally recognized term for a mining district of limited area, more or less definitely separated from others.

	I.	II.
Silver.....	297.70 oz.	285 oz.
Gold.....	\$2.16	\$1.44
Copper.....	28.9 %.	27.2 %.

Other small shipments have since been made of similarly rich ore, but no systematic plan has yet been adopted for working the mine on a large scale.

Other claims shew a greater amount of galena, which is apparently present in the "Silver King" ore in very small quantity only. The "Dandy Mine" and the "Tough-nut Mine" are mentioned as shewing veins from four feet to ten feet wide, the ore from the latter being stated to assay about \$100 to the ton in silver. About sixty claims in all have been partially prospected or opened up to a limited extent, most of these being within an area about three miles in length.

West of the silver-bearing veins, and upon Cottonwood Creek, near the Kootanie River, claims have been located which show rich free-milling gold-ores. These have lately been bonded for \$40,000, which amount is believed to be covered by the ore in sight, while another gold-bearing deposit has been purchased, the intention in both cases being to put in stamping machinery in the spring.

Most of the claims in this camp appear to be held by the discoverers at very high prices, which circumstance has up to the present time somewhat tended to prevent its rapid development.

Hot Springs Camp.—The Hot Springs Camp is situated on the west side of Kootanie Lake, about thirty-five miles from the last. It may be said to embrace an area of about five miles by three, lying between Coffee and Woodberry creeks. The country-rock is described as being a mica-schist, with associated magnesian limestone, and it is said that some of the veins can be traced without apparent break or interruption for distances of one or two miles, with widths varying from two to eight feet. The argentiferous galena appears to be somewhat irregularly distributed in these veins, with a thickness varying from a few inches to three feet. Near the lake the ores are stated to assay from twenty to forty ounces of silver to the ton, but at a greater distance and elevation, the ores appear to be more decomposed, assuming a rusty appearance, and being known to the miners as 'carbonate ores.' The ores of this class are generally found to be richer in silver. About sixty claims have been partially developed in this camp. During the past season a considerable amount of capital has been invested here and good prospects have sold well. The highest price so far paid for a claim is \$20,000, on a bond, a few days only after its discovery. Other claims and interests in claims have changed hands at prices ranging from \$5000 to \$1500. A considerable quantity of ore

Character of
ores and veins.

Gold ores.

Hot Springs
Camp.

Argentiferous
galena.

erminate
t which
ad Moun-
ings and
th silver
acterized
talliferous
iles and a
iles north
feet above
e deposits
ipally in a
, which is
a width of
prospected
iferous belt
f the high,
River. The
o the above
everal miles
nd Mountain
pest shaft at
he shafts or
most promi-
Hall Brothers
merican Flag."
of work has
parent width
six inches to
are no well-
ely with the
ned iron-ore,
eaks of what
. Assays of
700 ounces of
nt of twenty-
olded \$6463,
rwise concen-
ectively:—
nient and gener-
y separated from

is now being brought down to the edge of the lake in small lots for shipment.

Quantity and
quality of
the ore.

In a letter received from a gentleman well able to judge of the facts, it is said that in quantity the ore of the Hot Springs Camp will equal the Cour d'Alaine mines, while in quality the ores are much better, some of them carrying three or four times the amount of silver to the ton. According to the same authority, it is stated that it appears that there are several distinct veins running northerly and southerly for a distance of about five miles, all shewing a continuous body of fair grade ore, say thirty ounces to one hundred ounces of silver, and sixty per cent. or more of lead, and that for each hundred feet in vertical depth the various veins already discovered will eventually turn out 500,000 tons of shipping ore in the aggregate.

Various claims.

Of the numerous claims taken up in this camp, some of those which have attracted most attention, and for which notes are available, are enumerated below. As before explained, while unable to speak from personal knowledge of the accuracy of the statements made, I have every reason to believe that they are in the main correct:—

"Little Donald Mine."—Situated 1250 feet above the lake. Vein, eight feet wide, shows two feet and a-half of galena, which assays 60 to 130 ounces of silver to the ton, and 60 per cent. of lead. "Krao Mine."—Galena obtained here said to run over 100 ounces of silver to the ton, and a few tons of rich 'carbonate' ore yielded 280 ounces to the ton at Butte City. "Sunshine Mine."—Apparently a strong vein, six feet wide, but little developed. Runs N. 60° W., cutting across the others. Assays said to average sixty ounces silver to the ton. "Gallagher."—Situated higher up the mountain than those above-mentioned. Ore largely the so-called carbonate ore, i.e., galena, etc. decomposed by sub-aerial agencies, soft and easily worked. Assays said to run from 60 to 190 ounces silver to the ton. Contains about 10 per cent. of lead, with a large quantity of iron oxide. "No. 1 Mine."—On a line with the last. Ore of the same character. Assays from 60 to 500 ounces of silver to the ton.

Hendryx Camp.

Hendryx Camp.—Situated on the east side of Kootanie Lake, opposite Hot Springs Camp, the lake being here about a mile and a-half wide. The galena ores of this place are said to have been discovered by the botanist Douglas in 1825, and have frequently been referred to, but have only of late come into prominence, though locations have been taken up and successively abandoned several times. The ore is understood to be of comparatively low grade, but to occur in great mass and to be of easy access, being situated close to the shore of the lake. The "Blue Bell Mine" is owned by the New Haven Mining & Smelting Co., which has already spent \$100,000 in preliminary work. The galena

Character
of its ore.

Dr.
follows
"Th
veins,
* Summ

here occurs in a series of parallel veins, separated by bands of limestone, and associated with oxidized vein-matter. The vein is reported traceable on the outcrop for over 400 feet, and has been cut across at some depth by a tunnel 195 feet long, and shows in one place an unbroken body of galena ore 86 feet in width. The galena is said to assay from 15 to 40 ounces of silver to the ton. Several hundred tons have been shipped and several thousand are plainly in sight. The "Kootanie Chief" and "Comfort" mines, in the same vicinity, are owned by the Ainsworth Syndicate. Little development has yet been made on either of these, but their appearance is reported to be equally favourable with the last.

Great size
of veins.

In addition to the above recognized 'camps,' it may be stated that in this region numerous isolated 'prospects' of silver-bearing galena have been found in the same general district. One of these is situated about eight miles west of the Columbia River, near the Boundary; and another to the east of the Columbia, on the summit of the divide between Slocan Lake and Kootanie Lake. 'Prospectors' report a very large surface showing of galena at this place. Following the Lardo River, which enters the north end of Kootanie Lake from the north-westward, nearly on the line of the main metalliferous belt referred to on a former page, we find several lodes of silver-bearing ores reported, but respecting the extent or richness of these nothing absolutely certain is known. On the north-eastern arm of the Upper Arrow Lake, known as Galena Bay, locations have been recorded on a vein which is said to assay 50 ounces in silver to the ton, and on the head waters of Fish River, running into this bay, another vein is reported, yielding about 100 ounces in silver to the ton. Continuing a short distance still further northward, we reach the Illecillewaet River and line of the Canadian Pacific Railway.

Continuation
northward of
metalliferous
belt.

Illecillewaet Mines.—This group of mines is chiefly contained in the Illecillewaet. angle between the north and south branches of the Illecillewaet River, in a very mountainous country. Over 200 claims have been located here, and on sixty or seventy of these the work necessary to hold them under the provincial mining law, has been done. Some of the claims are not far above the valley, but many are high up in the dividing ridge between the two rivers, and the ore so far brought down from there has been carried on mule-back.

Dr. Selwyn describes the mode of occurrence of the ores here as follows.*—

Mode of
occurrence
of ores.

"The argentiferous galena of Illecillewaet occurs chiefly in quartz-veins, cutting a series of black carbonaceous or graphitic slaty shales,

* Summary Report Geol. Surv. Can., 1887, p. 4.

and thin bedded limestones, often much folded, but shewing an average dip of from 35° to 40° to E.N.E., and apparently flattening towards the summits of the mountains. Most of the veins are parallel with the stratification, though not unfrequently passing from one bed plane to that of another. No fossils have yet been found in these slates, but they closely resemble the black graptolitic shales, described by Mr. McConnell, p. 22 D, Annual Report Geological Survey, 1886, and may be of Cambro-Silurian (Ordovician) age."

Work done
on claims.

This group of mines has been, on the whole, more fully developed than any in the Kootanie region. During the past two years, galena and 'carbonate' ores have been shipped in larger or smaller quantities to Omaha or San Francisco, for smelting purposes. Work has been steadily carried on by several companies with a view to development. A two-thirds interest in one claim has been sold as a 'prospect' for \$16,000, and many 'prospects' have changed hands at \$3000 down to small or nominal sums. The Selkirk Mining & Smelting Company has sent out about 500 tons of ore, derived principally from the "Lanark Mine," which is situated in sight of the railway, but at an elevation of about 3000 feet above it. This ore is stated to have produced about 100 ounces of silver to the ton. The erection of an aerial wire tramway is contemplated. About 500 feet of tunnels have been driven to intersect the lode, the lowest being at 400 feet below the

Various claims.

level of the out-crops, and about 300 feet of drifting in the lode has been done. The same company holds the "Sutton," "Sprague," "Whale" and "Shark" claims to the north-west, and the "Isabella" and other claims in a south-easterly direction from the "Lanark." The Corbin & Kennedy Company also own several claims, of which their "No. 2" is stated at the present time to be the most promising. This vein is said to be from four to eight feet in width, and has been penetrated by tunnels for a hundred feet. It is a concentrating ore, and can be reduced to one-tenth by ordinary methods of concentration, the concentrates being reported to run from 300 to 400 ounces of silver to the ton. Promising veins of galena and grey copper ore are covered by other claims, from which assays running from 100 to 2800 ounces (in one instance) have been obtained, but no systematic work has yet been performed on any of the properties, with the exception of those above mentioned. Gold occurs only in traces in these ores. There is a crushing and sampling mill, capable of treating one hundred tons of ore a day, at Illecillewaet Station, on the railway, and a small village has sprung up there. This 'camp' seems to show every appearance of becoming a permanent ore-producing one of considerable importance.

Gold only in
traces.

* Report of

Big Bend.—Very little is yet known respecting the prospects of vein-mining in this part of the Kootanie region, but what information has been obtained is of a favourable character. There appear to be indications that the argentiferous belt runs northward from Illecillewaet through it. The placer-gold mines of the district have been referred to on a former page (p. 39 R), and a number of quartz-veins are reported, from which some exceedingly rich specimens of gold have been brought. Prospecting has, however, so far, chiefly been turned toward placer mines, of which Gold Creek and its tributaries are the most noted localities. These are reached by river, or by trail of about sixty miles in length from Revelstoke. It is probable that prospecting for veins will be actively carried on here in the near future. On Carnes and McCulloch creeks veins of argentiferous galena are reported.

In his official report for 1888, Mr. Sproat writes, of the West Koo-^{Future of the mines.}tanie District.—“We already, when nothing beyond ‘prospecting’ work on mineral claims has been undertaken, have marketed about 600 tons of silver-ore—most of it in galenite, of which total about 60 tons have returned over 300 ounces; 100 tons, 110 to 150 ounces; and 440 tons, 60 to 70 ounces, silver, per ton. The close of the season, and want of means of transport, alone prevented more of the higher grades from being marketed. The time is not far distant when I shall have to report to you a product of 500 tons a day of silver ores from this district, with a fair proportion of ores of high grade.”*

East Kootanie.—

What may be described as the East Kootanie division, includes the eastern slopes of the Selkirk and Purcell Mountains, the upper parts of the Columbia and Kootanie valley, (separating those ranges from the Rocky Mountains) and the western slope of the Rocky Mountain Range. The discoveries so far made of deposits of the precious metals in this district, other than placer-mines, appear to be confined to that portion of it to the south of the railway. Here, during the year 1888, according to Mr. A. W. Vowell, the Gold Commissioner, ^{Claims taken up.} 102 claims have been taken up, upon twenty-three of which assessment work has been performed; but with the exception of certain claims at Mount Stephen, no mining work of importance has yet been undertaken. The prospects of the district as a whole are, however, at the present moment extremely encouraging, and there is every reason to believe that mining will here before long be prosecuted with vigour.

The localities which have up to the present time attracted most ^{Principal localities.} attention, and round which most of the claims are gathered, are as follows:—Mount Stephen, near Field Station, Canadian Pacific Rail-

* Report of Minister of Mines of British Columbia, 1888, p. 302.

way; Otter-tail, near the station of the same name; Spilimichene and Jubilee Mountain, Columbia River; Spilimichene River, Second Fork; McMurdo district, near head of the Spilimichene River.

Mount Stephen At Mount Stephen (Tunnel Mountain) the four original claims, known as the "Monarch," "Cornucopia," "Alpha" and "Mogul," are stated to have been sold for \$25,000 to the British Columbia Smelting Company, which company has expended a large sum in opening up the deposits, and has already, to the end of 1888, shipped about 600 tons, chiefly from the "Monarch," to their works at Vancouver. The geological formation of this locality is fully described by Mr. R. G. McConnell in a late report of the Geological Survey,* where some account of the mineral deposits is also given. The ore is galena, which frequently appears in considerable mass, nearly pure. It seems to impregnate a zone of interbedded calcareous rocks, and had been traced for a considerable distance even before the work previously spoken of had been carried out. It is most favorably situated for shipment, but carries a very moderate amount only of silver, which, according to assays made in the laboratory of the Survey, varies from four to eleven ounces to the ton.

Otter-tail. At Otter-tail, one of the claims is situated directly under the railway-track, and several others at no great distance from it. In the report last referred to, the ore is described as an argentiferous galena, associated with some copper and zinc, and holding traces of gold. It occurs in quartz and calcite veins, which run parallel or nearly so to the strata of the calcareous schists and limestones of the district. The veins seldom exceed eighteen inches in thickness, but the ore is reported in some instances to contain a high percentage of silver. Several assays made in the laboratory of the Survey run from 5.8 to 113.7 ounces of silver to the ton.

Cinnabar. Further down the Wapta (Kicking Horse) River, not far from Golden, and also in the immediate vicinity of the railway, a vein of white calcite holding flecks of bright red cinnabar, has been 'prospected' to some extent.

Copper ores. The deposits of copper-ore met with in Copper and Castle mountains and in their vicinity, may also be alluded to here, though, as they occur to the west of the water-shed, they lie beyond the eastern boundary of British Columbia. Massive specimens of purple ore have been obtained at the first-mentioned locality, and some work has been attempted in connexion with the deposits, though so far without important results. The precious metals are found in these ores in very small quantity, and, generally speaking, the result of numerous assays made up to the present time, is to shew that neither the lead- nor copper-ores of the Rocky

* Annual Report Geol. Surv. Can., 1886, Part D.

Mountains proper in this region, compare favourably in this respect with those of the Selkirk and Purcell mountains.

Jubilee Mountain, situated on the west side of the Upper Columbia River, about thirty miles south of Golden Station, and in easy communication with that place by the river, has been the scene of considerable 'prospecting' operations during the past two years. The ore-deposits here are said to occur in a limestone formation and to be very massive, though of somewhat low grade in silver and containing scarcely any gold. The specimens received, show much copper in the form of copper-glance and other sulphurets and some galena. They are generally much decomposed, and present a rusty or greenish appearance. Assays of the richer specimens made in the laboratory of the Survey run from 5.1 to 39.37 ounces of silver. Thirty-five claims were recorded here or in this vicinity in 1888. Jubilee Mountain.

In the vicinity of the Spilimichene River, which flows into the Columbia thirty-seven miles south of Golden Station, active 'prospecting' has been in progress, the discoveries being in three groups, known as Spilimichene Mountain, Second Fork of Spilimichene River and McMurdo District, including the Middle Fork of the river. Not having had an opportunity of visiting these places, I am not in a position to give details relating to them. In 1888 nine claims were taken up in the first, nine in the second, and twenty-one in the third. The "Spilimichene" and "Rothschild" claims, taken up in 1884, are said to be upon a ledge of great size, containing galena and reported to average \$12 to the ton in silver, without concentration. Four claims, known as the "Southern Cross," "Monitor," "Great Republic" and "Old Dominion," in the McMurdo district, are stated to have been bonded for \$36,000, and others have been sold. Assays are said to run from \$15 to \$200, almost entirely in silver. Specimens of ores received consist of quartz, holding galena, with some tetrahedrite, copper-pyrites, etc. Two assays made in the laboratory of the Survey shew 13.88 and 37.53 ounces, respectively, in silver, but it is doubtful whether these fairly represent the general character of the ores. Vicinity of Spilimichene River.

Five claims have been recorded lately on Wild Horse Creek and a like number on Toby Creek, covering deposits of argentiferous galena. One from the first-mentioned place is reported to contain \$20 to \$80 in silver, from the second 65 ounces of silver to the ton. The lode on Toby Creek is said to be very large and well defined, and has been partly opened up on the "Jumbo claim." Wild Horse and Toby Creeks.

*Interior Plateau Region.***Principal localities.**

In a number of places in the southern part of the Province, included between the Gold and Coast ranges, or on the western and eastern flanks respectively of these mountain systems, discoveries of ores holding silver and gold have been made. Of these the following require special mention as being those in which groups of claims have been located and some 'prospecting' and exploratory work undertaken. Of these Stump Lake and Rock Creek are, however, the only ones which, as yet, are entitled to be called 'mining camps':—Cherry Creek, Rock Creek, Stump Lake, Jamieson Creek, Upper Tulameen, Cayoosh Creek, and Big Slide.

Cherry Creek.

The occurrence of exceptionally rich silver-ore at Cherry Creek, thirty-three miles east of the head of Okanagan Lake, has been known for a number of years, and several attempts have been made toward the development of the deposit, but difficulty has been experienced in following the vein. The "Hidden Treasure Mining Company" are at present engaged in prosecuting exploratory work on a scale more extensive than previously attempted, and apparently with fair prospects of success. The ore consists of argentiferous tetrahedrite or freibergite, with galena and blende, the gangue being quartz, and the country-rock blackish shales or slates. Average specimens broken from a large mass of the richer ore, yielded on assay 658.43 ounces of silver to the ton. In addition to the vein here particularly referred to, several other silver-bearing veins have been found in the same neighbourhood, and pellets of galena found in the sluice-boxes on the creek above the out-crop of the principal vein, yielded at the rate of 220.93 ounces of silver to the ton. These doubtless indicate additional silver-bearing deposits which have not yet been discovered.

"Monashee ledge."

Eight miles south-eastward from the placer-mines on Cherry Creek, on the south slope of the mountains between Cherry Creek and Kettle River, is the so called McIntyre or "Monashee" ledge. This is said to contain free gold. Some 'prospecting' has been done upon it and a trail has been cut out from Cherry Creek to the ledge.

Rock Creek and vicinity.

The general character of Rock Creek, situated a short distance north of the International boundary, and east of Osoyoos Lake, is elsewhere noted in connexion with its placer gold-deposits (p. 38 R). This locality has been visited by Mr. Bowman of the Geological Survey, but at the time little had been done in the matter of quartz discovery. During the past two years, however, general attention has here been turned in this direction, and very promising discoveries are reported, including both free-milling gold-ores (yielding some very rich specimens) and argentiferous galena-ores. On a claim known as the "Cariboo,"

a tunnel 200 feet in length is reported to have been driven, as well as a couple of shafts of fifty feet in depth. On the "Argen" claim, a prospecting shaft forty-two feet deep has been sunk, and the "Vancouver" has been opened to a depth of fifteen feet. On the "Eureka" is a shaft of about one hundred feet. A little mining town has already sprung up here.

At a place about twenty-five miles west of Rock Creek and twelve miles north of the Boundary-line, discoveries reported to be important have been made within the past few months. The ore is described as containing galena and free-milling gold. Twenty-eight locations have so far been recorded here.

In the year 1887, 200 claims were recorded in the vicinity of Stump Lake, and during the summer of 1888, I had the opportunity of examining a number of these, comprising all those upon which any considerable amount of work has yet been done. Some locations were originally taken up in this neighbourhood about six years ago, but 'prospecting' work appears first to have been undertaken in 1885. The principal developments are comprised within an area of about five miles in length, with a variable breadth, lying nearly north-and-south on the east side of the lake. The claims included in the property of the "Nicola Mining Company" and in the adjoining property of the "Star Mining Company," are those upon which the most extensive operations have been undertaken, confined, in the case of the first-named property, to development by means of several shafts and 'prospecting' on the surface. In the case of the second, a small crushing and concentrating plant has also been established. Development and 'prospecting' has also occurred to a considerable extent by the "Mary Reynolds Company" on the "Hepburn" group of claims, on the opposite side of the valley and further south than those above mentioned, and from these, some of the richest ore, of which very satisfactory trial shipments have been made, has been obtained.

Mr. W. J. Sutton reports that up to the end of the year 1888, about 2000 feet in all of good working shafts and tunnels have been run in the course of development of these Stump Lake or "Nicola" mines.

The metalliferous veins which have been found within the limited district above defined, are very numerous. They vary from about ten inches to five or six feet in width, and some of them have been traced for a length of several hundred feet. Though it is probable, from the great number of veins which exist, that no single one will be found to be continuous for a very great distance, a large supply of ore is already assured. Most of the veins run with very considerable uniformity in bearings a few degrees west of true north, or from N. 10° W. to N. 30° W. magnetic. There are, however, a few which diverge widely from

Nicola or
Stump Lake
mines.

Developments
made.

Character of
the veins.

this direction, and two or three which run nearly at right angles to it. The gangue is generally white quartz, and the principal metalliferous minerals present include iron- and copper-pyrites, galena, blende and tetrahedrite. Assays made in the laboratory of the Survey, run from 15 to 406.5 ounces of silver, with 0 to 6 ounces of gold per ton of 2000 lbs., according to the relative amounts of the various mineral constituents. The country-rock consists of altered volcanic materials of Palæozoic or Triassic age and may be generally characterized as a diabase-porphyrity, the most characteristic material in this place being a rock of green and green-grey colour with coarse porphyritic crystals of plagioclase and pyroxene.

Encouraging prospects.

On the whole, the prospects for the immediate development of an important mining district are here most encouraging. The occurrence of these ores in the green, altered, volcanic rocks, which under slightly varying forms occupy so large an area of the southern interior of British Columbia, is a feature of peculiar interest, inasmuch as it leads to the belief that these wide-spread rocks become a metalliferous series where the other conditions are favourable.*

Jamieson Creek

In the vicinity of Jamieson Creek, which flows into the North Thompson from the west, fifteen miles from Kamloops, a number of claims have been recorded within the past two years, though very little work has yet been done on them. The veins occur in a mass of greyish granite, which breaks through certain black micaceous schists or argillites which form an important intercalation in the Palæozoic rocks, generally of volcanic origin, of this part of the Province. The granite is highly silicious in the vicinity of the veins, and these appear to have been produced contemporaneously with the intrusion of the granite. The gangue is quartz and contains pyrites, with a little galena, blende and tetrahedrite. Assays made in the laboratory of the Survey shew from seven-tenths to one ounce of gold and two and a-half to thirty-four ounces of silver to the ton. Little can as yet be proved respecting the continuity of the veins in this district, and the area within which claims have been recorded is comparatively small. The surface display of quartz is, however, considerable, and this, with the rich character of the ores, would appear to warrant some expenditure of a tentative character. The thickest vein seen is from five to six feet in width. It may further be mentioned in this connexion that similar veins were seen by us near the the head-waters of Jamieson Creek.†

* See Summary Report Geol. Surv. Can., 1886, p. 6. Report of Minister of Mines of B.C., 1887, p. 275.

† See Summary Report Geol. Surv. Can., 1888, p. 7.

On the Upper Tulameen, above Granite Creek, several quartz-veins ^{Tulameen region.} have lately been discovered, but nothing except a limited amount of preparatory work has yet been done toward their development. I may state, however, that the district appears to be worthy of attention by the 'prospector,' as it presents very favorable indications, and the rocks often show evidence of solfataric action, being highly silicified and holding much pyrites in certain belts. A specimen of ore collected by myself at the "Bonanza Queen" location, has since been ascertained on assay to contain 1·3 ounces of gold, and 5·1 ounces of silver, to the ton of 2000 pounds. A remarkable indication of the existence somewhere in the Tulameen basin of extremely rich ores, is found in the discovery in sluice-boxes on the river, about thirteen miles above Granite Creek, of small rolled pellets of pure silver-glance strung through with filamentous gold.

On Mad River, a tributary of the North Thompson above the Clear- ^{North Thompson.} water, a vein has been discovered and prospected, a specimen from which yielded on assay in the laboratory of the Survey gold 4·37 ounces silver 21·35 ounces to the ton. Locations have also been made on the Clearwater, Deception Creek and Mahood Lake, but their character has not been proved.

The quartz-veins recently found on Cayoosh Creek, near Lillooet, ^{Cayoosh Creek.} about twelve miles up the creek, are the sources from which the gold of the rich placer-deposits which have been worked there during the past few years, has been derived. Assays of quartz from these veins made in the laboratory of the Survey, give a remarkably favorable showing, the gold being free and minutely and uniformly distributed through the rock. These assays run from 0·722 to 0·992 ounces in gold to the ton. The country-rock is a dark, slightly micaceous slate or schist. This is much broken up and disturbed, and the veins are very numerous, but small and apparently irregular. It would appear to be worth ascertaining, at this place, whether some portions of the rock with its included veins would not pay for extraction and crushing as a whole. The work yet done here is merely 'prospecting.' A discovery is reported to have been made in 1888, in this vicinity, between the head of Anderson Lake and McGillivray Creek, of a strong lode of quartz containing galena, and assaying to the value of \$46 in silver with \$14 in gold to the ton.

On the "Big Slide Mine," the property of the Foster Mining and ^{"Big Slide mine."} Milling Co., a considerable amount of work has been done and expenditure incurred in bringing in and erecting crushing and chlorinating machinery, etc. The deposit, which was discovered in 1872, is situated on the bank of the Fraser River near the mouth of the Kelly Lake Creek. The vein is reported to be from fifteen inches to five feet in

width and traceable for a long distance. The average value of the ore is reported as \$22.50 to the ton, of which \$20 is gold. The highest assay reported is one of \$118. Operations are at present suspended, owing to difficulties met with in saving the gold.*

Coast Ranges.

Silver mines
near Hope.

The most important discovery of silver-ore yet made in the Coast Mountain belt is that near Hope, on the Fraser. The veins here run through a mass of conglomerate which caps a mountain known as Silver Peak, of which the lower part is composed of granitoid rocks. The conglomerate is believed to be of Cretaceous age. Difficulties which have occurred in connexion with ownership, have unfortunately so far prevented the working of this very promising deposit. The following notes concerning it are chiefly derived from the Report of the Minister of Mines of British Columbia for 1874, p. 16.

"Eureka" and
"Van Bremer"

About 1871, veins of silver-ore were discovered in the Coast Mountain Range at Fort Hope about six miles south of the town. The first vein discovered, named the "Eureka," crops out about 5000 feet above the river-level, is well defined, and from four to seven feet thick, and has been traced 3000 feet. A tunnel 210 feet long has been driven into this vein. For milling purposes, the ores would have to be lowered about 3000 feet to Silver Creek, distant about 6000 feet. The ore is described as argentiferous grey copper, and contains from \$20 to \$1050 of silver to the ton. While this vein was being opened, another, about 300 feet distant, was discovered. This is much richer, and is called the "Van Bremer." The ore is described as chloride of silver, and the vein contains from \$25 to \$2403 of silver to the ton. A quantity taken from the out-crop sold at San Francisco for \$420 a ton. This vein can be traced for half a mile.

A specimen of the Hope silver-ore—"a yellowish decomposed vein stone"—assayed by Dr. Harrington gave 271.48 ounces of silver to the ton of 2000 lbs. It also contained lead, copper, antimony, iron, arsenic and sulphur.

A specimen from the "Eureka" mine—"a vein-stone of spathic iron with some quartz"—assayed by Dr. Hunt, gave 347.08 ounces of silver to the ton of 2000 lbs., and contained also copper, antimony and sulphur.

"Murphy's
Mine."

About two miles above Hope, on the opposite side of the Fraser, a vein occurs which is reported to hold silver to the value of \$15 to \$45 to the ton. Some work has been done here in former years, and a tunnel 540 feet long driven for the purpose of intersecting the vein.

* See Reports of Minister of Mines of B.C., 1886, pp. 211, 218, 1887, p. 273.

Some work has also been carried on from time to time, but so far Yale. without leading to any considerable developments, on veins situated on Yale Creek, near the town of Yale. Ore from the "Queen Mining Company's" claim is reported to contain galena, blende, iron- and copper-pyrites and to have afforded assays as high as \$38 to the ton, in silver.*

Omenica.

The situation and character of the Omenica country has already been noticed in connexion with its gold-placers (p. 41 R). In association with the gold in some of the creeks, arquerite, a species of silver amalgam presenting the outward appearance of native silver, is found in grains and nuggets (p. 145 R). This mineral consists of silver combined with mercury.† It has not yet been found in place either here or elsewhere in the Province, but it is worth noting that it constitutes the principal ore in the mines of Arqueros, Coquimbo, Chili. Also, however, in the immediate neighbourhood of the gold-deposits is a number of large veins carrying highly argentiferous galena, which, from the accounts received of them, appear to require only improved means of communication to ensure their profitable working. A number of claims were at one time taken up upon these, but they have probably since been abandoned. The "Arctic Circle" and "Black Warrior" are adjoining claims on Boulder Creek. The former is said to shew a vein twenty feet wide with about four feet of highly metaliferous ore. The latter is described as a vein eight feet wide of nearly pure galena. Other specimens of similar ores have been obtained from several places within a radius of eight miles of these. The "Champion ledge" is situated near Lost Creek and is similar in character, but particulars concerning it are wanting. Another vein on this creek is reported to be twenty feet wide. Assays run from 29.8 ounces to 128 ounces in silver to the ton, the last mentioned representing a galena free from gangue. Some specimens also carry an appreciable quantity of gold.‡

Other Localities.

Still further north-westward, in the same general line, is the Cassiar District (p. 43 R), in which practically nothing has yet been done toward the discovery or development of any but placer-mines. Large

* See Reports of the Minister of Mines of British Columbia, particularly report for 1879, p. 245.

† The mineral when pure consists of silver 68.5 per cent. Mercury 13.5 per cent. A nugget from this district, analysed by Messrs. Riotte and Leckhardt, of San Francisco, contained silver 83.80 per cent, mercury 11.00, lead 0.40, copper 0.20, as well as traces of gold, platinum, and iron.

‡ Report of Progress, Geol. Surv. Can., 1879-80, p. 110 B.

veins of quartz are reported to occur in the vicinity of some of the auriferous streams, and an attempt was at one time made to work some of these on a small scale by means of an arastra. Argentiferous galena ores also occur here, a specimen of one of which, from the South Fork of McDame Creek, on assay in the laboratory of the Survey proved to contain 75 ounces of silver to the ton, while still higher assays have been reported.

Silver-ores in
Yukon district.

Far beyond the northern boundary of the province of British Columbia, and still following the same belt of country, upon Forty-mile Creek, near the point at which the Yukon crosses the 141st degree of longitude (p. 44 R), argentiferous galenas are again found, one of which, collected by Mr. W. Ogilvie and lately examined, contains over 38 ounces of silver to the ton.

Queen Charlotte
Islands.

It is not possible here to include mention of the numerous isolated localities in which discoveries of ores of unproved value have been made, or in which they have been reported. A number of these appear in the list of localities and in the table of assays on later pages. Allusion is elsewhere made to the exceptionally rich, though apparently quite limited gold vein of Mitchell Harbour, in the Queen Charlotte Islands (pp. 17 R, 143 R). This occurrence seems, at least to hold out encouragement for further search in the rocks of the same character as these in which it is, and which are very largely developed upon the coast of the Province.

Texada.

During the last few months attention has been drawn to the existence of gold-bearing veins on Texada and a considerable amount of 'prospecting' has been carried out on the island and a large number of claims have been recorded. The ores are said to be pyritous and favourable assays are reported, but I am unable to give any definite particulars respecting them. Their character will doubtless be fully proved during the coming summer.

"Stirling
Mine."

Reference may also be made here to the "Stirling Mine," Kokesila River, about twelve miles from tide-water, Cowichan District, Vancouver Island. Some 'prospecting' work has been done here. The ore is an argentiferous galena with some gold, and assays are quoted showing from \$10 to \$75 in silver to the ton.*

* Report of Minister of Mines of British Columbia, 1880, p. 431.

some of the
de to work
argentiferous
, from the
tory of the
n, while still

ritish Colum-
Forty-mile
st degree of
one of which,
ains over 38

erous isolated
re been made,
appear in the
es. Allusion
h apparently
een Charlotte
st to hold out
me character
ped upon the

to the exist-
le amount of
arge number
pyritous and
o any definite
tless be fully

ine," Kokesila
District, Van-
here. The ore
e quoted show-

TABLE OF SELECTED ASSAYS OF ORES FROM BRITISH COLUMBIA, CONTAINING GOLD AND SILVER.

NOTE. Most of the assays quoted here in summary form, have been made in the Laboratory of the Geological Survey. The various reports in which there are given at length, are denoted simply by the date and page, in the last column. Those to be included in the report for 1888, have not yet been published. A few additional authentic assays from other sources, are also quoted. (Names of minerals specially prominent in any ore are printed in italics.)

Cariboo District.

No.	LOCALITY.	ASSOCIATED MINERALS.	GOLD: Ounces.	SILVER: Ounces.	Reference.
1	"Big Bonanza," between Williams and Lightning Creeks, Cariboo. (Highest assay of specimens received)	Quartz with some pyrites	0.554	.....	76-77, p. 478
2	Cariboo, average of 9 samples (separate localities not stated.)	Rusty quartz with limonite and iron-pyrites	1.424	0.766	77-78, p. 49 a.
3	"Discovery claim," Little Snow-shoe Ck., Cariboo.	Galena and iron-pyrites	0.408	0.068	87, p. 40 T.
4	"Flynn's diggings," Mosquito Ck., Cariboo.	Quartz with <i>pyrites</i>	0.182	36.458	87, p. 44 T.
5	"Southern ledge," Grouse Ck., Cariboo.	Quartz, chlorite, iron-pyrites, galena.	2.042	0.222	87, p. 45 T.
6	"Parker's ledge," Barkerville, Cariboo.	.....	0.787	20.738	87, p. 45 T.
7	"Horne Rule ledge," Barkerville, Cariboo.	Rusty Quartz with galena	.....	25.021	87, p. 45 T.
8	"Perkins ledge," Burns Mt., Cariboo.	Galena, quartz, iron-pyrites.	0.385	29.843	87, p. 46 T.
9	Hixon Creek Mine, Cariboo.	Quartz with copper-glance, copper-pyrites, galena, etc. (Concentrates).	0.403	1.225	87, p. 47 T.
10	" "	.....	0.583	29.963	86, p. 37 T.
11	" "	.....	.....	18.229	86, p. 37 T.
12	" "	.....	8.021	.....	.....

West Kootanie.

13	Toad Mountain	Association of limonite, calcite and quartz, with copper-pyrites, tetrahedrite and iron-pyrites.	.....	19.687	1888.
14	Toad Mountain (vicinity of "Silver King Claim," Toad Mt., (assay by Johnson & Matthey).	Bornite and quartz	.....	119.215	87, p. 50 T.
15	"Silver King Claim," Toad Mt., (assay by Johnson & Matthey).	(Specimens collected by Mr. R. D. Atkins).	trace.	771.000	.....
16	"Silver King Claim," Toad Mt., (assay by Johnson & Matthey).	.....	trace.	422.000	.....
17	"Silver King Claim," Toad Mt., (assay by Johnson & Matthey).	.....	trace.	75.900	.....
18	"Silver King Claim," Toad Mt., average assays of trial shipment, in two lots	Contained copper 28.9 p. c.	0.108	297.50	.....
19	"No. 1 Claim," Hot Springs Camp, Kootanie Lake.	Decomposed vein-stuff with galena "carbonate ore"	0.072	285.95	.....
20	" "	.....	trace.	214.637	1888.

21 "Lu-lu Claim," west side Kootanie Lake
 22 "International Claim," west side Kootanie Lake
 23 "Fifteen mile up Fish River, Upper Arrow Lake.
 24 "Illecillewaet River."
 25
 26
 27
 28
 29
 30
 31
 32
 33
 34
 35
 36
 37
 38
 39
 40
 41
 42
 43
 44
 45
 46
 47
 48
 49
 50
 51
 52
 53
 54
 55
 56
 57
 58
 59
 60
 61
 62
 63
 64
 65
 66
 67
 68
 69
 70
 71
 72
 73
 74
 75
 76
 77
 78
 79
 80
 81
 82
 83
 84
 85
 86
 87
 88
 89
 90
 91
 92
 93
 94
 95
 96
 97
 98
 99
 100

No.	LOCALITY.	ASSOCIATED MINERALS.	GOLD.		SILVER.		Reference.
			Ounces.	Traces.	Ounces.	Traces.	
65	Spillimichen River, Purcell Range.	Galena and iron-pyrites.	traces.		8.004		85, p. 27.
66	"Golden Gate Claim," Caribou Creek, McMurdo District.	Quartz with <i>terradrite</i> , galena, iron-pyrites.	traces.		19.587		1884.
67	"McDon Claim," Middle Fork Spillimichen.	Galena.	traces.		37.527		1884.
68	Tolson Creek, McMurdo District.	Quartz with <i>galena</i> .	traces.		38.646		1884.
69	North Fork Toiy Creek.	Coarse crystalline galena.	traces.		66.354		1884.
70	Goat River, Kootanie.	Galena with quartz and iron-pyrites.	traces.		14.583		85, p. 40.
<i>Big Bend Region.</i>							
71	"Taylor Lead," Big Bend.	Quartz, with galena and iron-pyrites.	0.175		0.641		88, p. 38.
72	"Little Bunting Lead," Big Bend.	Quartz, with ferric hydrate and mica.	1.925		0.175		86, p. 38.
73	Big Bend District.	Quartz, with galena.	traces.		43.789		86, p. 38.
74	North Lead, Columbia Claim, McCulloch Ch., Big Bend.	Rusty quartz, with galena.	traces.		16.975		86, p. 39.
75	"Silver King Mine," Big Bend.	Galena, specular iron, quartz.	traces.		21.875		86, p. 38.
<i>Omenica.</i>							
76	"Champion Ledge," near Lost Creek, Omenica.	Quartz, with galena and pyrites.	traces.		19.723		75-79, p. 24.
77	"Arctic Circle Claim," Boulder Creek, Omenica.	Galena, iron oxide.	traces.		128.078		75-79, p. 25.
78	"Arctic Circle Claim," Boulder Creek, Omenica.	Galena, iron oxide.	traces.		44.2		75-80, p. 11.
79	"Arctic Circle Claim," Boulder Creek, Omenica. (Assay by Johnson & Matthey.)	Galena, iron oxide.	traces.		40.81		75-80, p. 11.
80	"Black Warrior Vein," Boulder Creek, Omenica. (Assay by Johnson & Matthey.)	Galena, iron oxide.	traces.		29.06		75-80, p. 11.
81	"Black Warrior Vein," Boulder Creek, Omenica. (Assay by Richn, Hemme & Co.)	Galena, iron oxide.	traces.		93.00		75-80, p. 11.
82	"Mammoth Ledge," Omenica. (Assay by Thos. Price.)	Galena, iron oxide.	traces.		32.40		75-80, p. 11.
83	"Mammoth Ledge," Omenica. (Assay by Richn, Hemme & Co.)	Galena, iron oxide.	traces.		91.13		75-80, p. 11.
84	"Vein near Manson Creek, 20 miles from 'Dunkeld,'"	Quartz, with a little galena.	traces.		8.971		75-78, p. 40.
<i>Cassiar.</i>							
85	"Acadia Claim," South Fork of McDane Creek, Cassiar.	Galena, iron- and copper-pyrites, etc.	traces.		74.772		1893.
<i>Yukon District.</i>							
86	Forty-mile Creek, Yukon District.	Chiefly galena.	traces.		38.646		

Interior Plateau Region.
Galena, somewhat oxidized.

87 "Carbonate Ledge," Rock Creek (Laboratory of Surrey)
88 "Bonanza Queen," Tlameen R. (Laboratory of Surrey)
89 "Cherry Creek Mine"

Galena, iron- and copper-pyrites, etc.

Yukon District.

traces. 38.646

85 Forty-mile Creek, Yukon District.

Interior Plateau Region.

87	"Carbonate Lode," Rock Creek (Laboratory of Survey)	Galena, somewhat oxidized	traces	61.165	77-78, p. 500.
88	"Bonanza Queen," Tulameen R. (Laboratory of Survey)	Iron- and copper-pyrites, etc., with some galena in quartz.	1.382	638.437	77-78, p. 500.
89	Cherry Creek Mine	Quartz, with tetrahydroite, galena and zinc blende	traces	255.957	77-78, p. 500.
90	Cherry Creek (found in sluice-boxes)	Galena	0.658	8.254	77-78, p. 500.
91	North Fork of Cherry Creek	Quartz, with galena, pyrites, etc.	0.759	406.574	87, p. 387.
92	Hepburn Claims, near Stump Lake	Rusty quartz, galena	0.729	104.771	85, p. 377.
93	"Nicola Mining Company," Stump Lake	Quartz, with galena, tetrahydroite, iron-pyrites, copper-pyrites, bornite	traces	40.353	87, p. 387.
94	Stump Lake (vicinity of)	Galena, copper-pyrites, etc.	0.729	40.353	87, p. 387.
95	" "	Quartz, with galena, etc.	0.729	40.353	87, p. 387.
96	" "	Quartz, with tetrahydroite, galena, iron-pyrites and blende	0.729	40.353	87, p. 387.
97	" "	Quartz, with galena and iron-pyrites	traces	20.967	84, p. 357.
98	" "	Quartz, with galena	0.729	15.064	84, p. 357.
99	" "	Quartz, with galena, iron-pyrites and copper-pyrites	1.969	17.063	86, p. 387.
100	"Zeran Mine," Scotch Creek, Shuswap Lake	Galena, copper-pyrites, quartz and calcite	traces	33.000	86, p. 387.
101	" "	Galena quartz	traces	40.353	87, p. 387.
102	" "	Galena, iron-pyrites, quartz	traces	40.353	87, p. 387.
103	" "	Rusty quartz, with a little galena	0.853	21.525	1888.
104	"Home-Stake," Jamieson Creek, N. Thompson	Rusty quartz, with a little galena	0.758	25.942	1888.
105	"Silver King," Jamieson Creek	Rusty quartz, with a little galena	6.700	25.200	1888.
106	"Silver Queen," Jamieson Creek	Rusty quartz, with galena and iron-pyrites	4.371	21.350	87, p. 387.
107	Mad River, N. Thompson, above Clearwater River	Quartz, etc.	0.842	0.901	1888.
108	Grown Point Ledge, left bank Cayoosh Creek	Rusty quartz	0.722	0.901	1888.
109	"Bonanza Location," right bank Cayoosh Creek	" "	dist. trace.	20.533	1888.
110	South Fork Bridge River	Rusty quartz, with carbonates of copper	1.21	2.43	1888.
111	"Big Slide Mine," Fraser R. (assay at Nevada Metallurgical Works)	Quartz, with pyrites, etc.	traces	5.953	1888.
112	Fraser River, 25 m. above Lytton	Tetrahydroite	traces	2.167	1888.
113	Fraser River, 25 m. above Lytton	Schistite	traces		
114	Fraser River, 25 m. above Lytton	" "			
115	Fraser River, 25 m. above Lytton	" "			
116	Fraser River, 25 m. above Lytton	" "			

Coast Ranges and Coast.

117	"Kureka Mine," near Hope	Yellowish decomposed veinstone	221.668	76-78, p. 472.
118	" "	" "	217.46	77-78, p. 472.
119	" "	" "	217.46	77-78, p. 472.
120	"Yale Creek Mine," Yale (three assays by J. H. Collins)	Iron-pyrites, blende and a very little copper-pyrites	18.70	85, p. 284.
121	"Queen Mine," Yale Creek	Chiefly blende and iron-pyrites	9.844	79-80, p. 500.
122	"Selling Mine," Koksaula River, Cowichan, V.I.	Galena and copper-pyrites, dolomite and quartz	19.323	79-80, p. 500.
123	" "	" "	8.021	79-80, p. 500.
124	" "	" "	5.104	79-80, p. 500.
125	" "	" "	40.249	87, p. 387.
126	"Malaspina Copper Mine," Texada I.	Copper-pyrites, iron-pyrites, etc.	4.433	87, p. 387.
127	"Kitamat Ledge," Gardner Inlet	Quartz, with copper-pyrites, blende, galena	1.079	77-78, p. 472.
128	Six miles up Zymoetz River, Skeena	Quartz, with galena, copper- and iron-pyrites	0.629	77-78, p. 472.

COAL.

Discovery of
coal near
Suquash.

Steamer
Beaver.

Discovery of
coal at
Nanaimo.

Initiation of
mining.

Wellington
mines.

Other mining
enterprises.

The discovery of coal in British Columbia antedated that of gold by more than twenty years, but did not at first produce any effect comparable with that of gold upon the history of the country. Dr. W. F. Tolmie was the first to make known the existence of coal, on the coast of the Province, in 1835. He was then stationed at the Hudson Bay Company's post, known as Fort McLoughlin, on Milbank Sound, and specimens of coal were brought to him by Indians from the north-east coast of Vancouver Island,—doubtless from Suquash. The steamer *Beaver*, belonging to the Company, arrived on the West Coast in 1836, and thereafter small quantities of coal were obtained for her, as well as for blacksmiths' use, from this place; being derived from natural outcrops on the beach. In the year 1849, a coal-miner was brought out by the Company, from Scotland, to more fully test the character of the coal on this part of the coast, and in 1851 a further number of miners and some necessary machinery were imported. Exploratory work by sinking and boring was prosecuted along the coast of Vancouver Island, between Port McNeill and Beaver Harbour, till 1853, but without resulting in any very notable discoveries.

Meanwhile, in 1850, the existence of coal at Nanaimo had been ascertained by Mr. J. W. McKay, and in the following year it appears that the most of the miners above referred to were transferred from the northern end of the island to that place. Work began in earnest at Nanaimo in 1852, and before the close of 1853, 2000 tons are reported to have been shipped, chiefly to San Francisco. The price of coal at Nanaimo was at this time \$11 and at San Francisco \$28 a ton. The Hudson Bay Company, under the name of the Nanaimo Coal Company, continued to work the mines thus opened till 1861, when these were sold to the Vancouver Coal Mining and Land Company (limited), by which they are still operated. The total shipment from October, 1852, to November, 1859, are returned at 25,398 tons.*

The Wellington Mines, situated a short distance inland from Departure Bay, near Nanaimo, began to produce coal in 1871, and several hundred tons of coal were shipped in that year. This colliery, like the last, has since continued in active operation, with yearly increasing output, and from the various openings belonging to these two enterprises by far the greater part of the coal product of the Province is obtained.

In 1871 mining operations were in progress at Cowgitz, Queen Charlotte Islands, and several hundred tons of anthracite were shipped, but the work was not continued. In 1874 the Harewood Colliery, near

* For many details on the early history of the industry see Bancroft's Works, vol. xxxii., pp. 135, 565; also Annual Report Geol. Surv. Can., 1886, pp. 65 B., 66 B.

* This inclu
† This table
mines. I an
not previous
‡ These and
the ton of 224

Nanaimo, was opened. It had previously been worked on a small scale in 1864 and 1865. In 1875 the Baynes Sound Colliery, near Comox, was opened out to some extent, and preparations for mining and shipping coal were made, but from various causes, chief among which was the low price of coal, both this and the Harewood were closed down in 1877. In 1882 a shaft was sunk at the East Wellington Colliery, about midway between the Vancouver and Wellington mines, and a certain amount of coal has since been annually produced here.

With the exception of the Baynes Sound mine, the collieries above mentioned are all in the Nanaimo area, and the work done in the Comox area (except in the case of the Baynes Sound mine) was of the character of 'prospecting' and exploration only. In 1888, however, the serious development of mining work in the Comox area has been initiated by Hon. R. Dunsmuir at points situated between the old Baynes Sound mine and Comox Harbor, near the edge of the old "Union Claim." A railway, eleven miles in length, has been built to a suitable shipping place, and all preparations are being made for a large output of coal. This enterprise is known as the Union Colliery.

Since the initiation of coal-mining in the Nanaimo district, this industry has shewn a steady and satisfactory increase, and it has now attained large proportions, as evidenced by the subjoined table of output. Both the exports and the local consumption are constantly increasing, the latter being returned at 115,953 tons in 1888.*

TABLE SHEWING THE ANNUAL PRODUCTION OF COAL IN BRITISH COLUMBIA.†

	Tons.‡	Annual and total output of coal.
Coal mined at Suquash by H. B. Co. at various times between 1836 and 1852 (say).....	10,000	
Total coal shipped from Nanaimo, October, 1852, to November, 1859.....	25,398	
1859 (Two months).....	1,989	
1860.....	14,247	
1861.....	13,774	
1862.....	18,118	
1863.....	21,345	
1864.....	28,632	
1865.....	32,819	
1866.....	25,115	
1867.....	31,239	
1868.....	44,005	
1869.....	35,802	
1870.....	29,843	

*This includes the coal used at the mines.

† This table is I believe the first approximately complete statement of the annual output of the mines. I am indebted to Mr. S. Robins and Hon. R. Dunsmuir for the figures relating to years not previously published.

‡ These and other figures relating to coal, (except California imports on following page) refer to the ton of 2240 lbs.

	Tons.
1871 (Exclusive of Wellington Mines).....	35,643*
1872 " " ".....	46,468
1873 " " ".....	45,731
(Wellington Mines, 1871-73.....)	(21,182)
1874.....	81,547
1875.....	110,145
1876.....	139,192
1877.....	154,052
1878.....	170,846
1879.....	241,301
1880.....	267,595
1881.....	228,357
1882.....	282,139
1883.....	213,299
1884.....	394,070
1885.....	365,596
1886.....	326,636
1887.....	413,360
1888.....	489,301
Total.....	4,358,221

Places to
which coal is
exported.

The exports of coal are chiefly to ports in California, including, in 1888, San Francisco, Wilmington and San Diego. Sundry cargoes were also shipped to Seattle, W.T.; Portland, Oregon; Alaska; Petropavlovsk; Hawaiian Islands; China and Japan. Coal has also been supplied during the year to H.M. Navy, and to U.S. war and revenue vessels as well as to ocean mail steamers and other vessels calling for fuel.

Coal imports of
California.

The standing of British Columbia coal in respect to the supply of California, which constitutes the principal market, is well shown by the subjoined statement of the sources of coal imported into that State in 1888.†

	Tons.
British Columbia.....	345,681
Australia.....	271,612
England and Wales.....	126,167
Scotland.....	10,680
Eastern States (anthracite, etc.).....	30,118
Total from coal mines on or near Puget Sound, W.T., including Seattle, Carbon Hill, Green River, Cedar River, Renton, Newport, South Prairie, etc.....	568,948
Coos Bay.....	47,015
Japan.....	13,808
Coal from various sources, other than British Columbia, received at Wilmington and San Diego, (estimated at)	151,068

Total coal imports of California in 1888 1,565,097 tons

* Including 566 tons Queen Charlotte Islands anthracite.

† These statistics, and the places of destination of coal above, from Report of Minister of Mines of B.C., 1888, p. 330.

The following particulars for the various collieries in operation in Nanaimo and Comox, are derived from the Report of the Minister of Mines of British Columbia for 1888.—

Nanaimo Colliery.—Description of seams and workings.—South Field No. 2, worked by slope, seam, 6 to 10 feet thick. South Field No. 3, worked by shaft, seam, 5 to 10 feet thick. No. 1 shaft, seam, 5 to 12 feet thick. Total out-put 258,817 tons, 8 cwt.

Wellington Colliery.—Description of seams and workings.—Four working shafts, known as No. 3 pit, No. 4 pit, No. 5 pit, No. 6 shaft (sinking.) Three air shafts. Seams 6 to 10 feet thick. Total out-put 198,392 tons.

East Wellington Colliery.—Description of seams and workings.—Two shafts, known as Nos. 1 and 2 respectively. Total out-put 30,092 tons.

Union Colliery.—(Comox).—Description of workings.—One shaft, one slope, four levels, three tunnels, one air-shaft. Total out-put 2000 tons. (This mine is in process of being opened.)

The number of miners employed in the various Collieries in 1888, is as follows :—

	Boys.	Whites.	Chinese.	Indians.	Total.
Nanaimo Colliery....	30	819	85	16	945
Wellington Colliery ..	10	585	100	None	695
E. Wellington Colliery	2	120	10	None	132
Union Colliery.....	None	90	150	None	240

Total miners employed in 1888. 2012

The wages paid to white miners at present, range from \$2 to \$4 a day, and the earnings of miners working on contract from \$3 to \$4.50. Chinese are paid at from \$1 to \$1.75, and Indians about \$2 a day.

Several serious accidents from explosion of fire-damp have occurred in the history of the Nanaimo mines, viz.—Wellington Colliery, April 17, 1879, 11 lives lost; No. 1 Pit, Vancouver Colliery, May 3, 1887, 150 lives lost; No. 5 Pit, Wellington Colliery, Jun. 24, 1888, 77 lives lost.

Coal- and Lignite-bearing Formations of British Columbia.

While the coals of Nova Scotia and of the eastern half of the United States are derived from the Carboniferous formation, of Palaeozoic age, those of the Great Plains and Pacific Slope occur in association with much newer rocks, referable to the Mesozoic and Tertiary periods. Though in the western part of the continent rocks of Carboniferous age are known, and frequently appear in great thickness and covering extensive areas, they generally represent the

Coal-bearing formations of the East and West.

accumulations which have taken place in sea-bottoms, and consist largely of limestone; the swamps and marshy estuaries which afforded the conditions for the accumulation of vegetable matter elsewhere giving rise to the production of coal-beds, do not, so far as yet known, appear to have occurred during this period, in the West. Conditions of this kind, however, existed very generally in the West during certain stages of the Mesozoic and Tertiary, while rocks of these periods are developed on a comparatively small scale in the eastern half of the continent, and are there seldom found to contain coal.

Coal producing
rocks of British
Columbia.

In British Columbia, the formations known to contain mineral fuels of economic value, of the character of coals or lignites, are (1) the Cretaceous, or highest member of the Mesozoic, (2) the Tertiary. Respecting the latter, it is not yet clear whether all the coal- or lignite-bearing rocks included under it are referable to a single stage, but it is probable that at least most of them belong to the middle member of the Tertiary, or Miocene.

Fuels of the
Cretaceous and
Tertiary.

Rocks of Cretaceous age are developed over a considerable area in British Columbia, often in very great thickness, and fuels occur in them in important quantity, in at least two distinct stages, of which the lower and older includes the coal-measures of the Queen Charlotte Islands and those of Quatsino Sound on Vancouver Island, with those of Crow Nest Pass in the Rocky Mountains; the upper, the coal-measures of Nanaimo and Comox, and probably also those of Suquamish and other localities. The lower rocks hold both anthracite and bituminous coal in the Queen Charlotte Islands, but elsewhere contain bituminous coal only. The upper have so far been found to yield bituminous coal only. The fuels of the Tertiary rocks are, generally speaking, lignites, but include also various fuels intermediate between these and true coals, which in a few places become true bituminous coals.

All grades of
coal
represented in
British
Columbia.

The series of mineral fuels thus presented by British Columbia alone, ranging from anthracites which compare favourably with those of Pennsylvania and Wales, to lignites, in which the original woody structure is still clearly preserved, and all embraced within the upper part of the Mesozoic and the Tertiary, is sufficient to disprove the theory at one time maintained, that the Carboniferous formation is the only one capable of yielding true coals. It is now generally acknowledged, that the character of such fuels depends essentially on the conditions of metamorphism to which they with the rocks containing them have been subjected, and only in secondary degree on their relative or absolute age.

Order of
description.

It will, however, be most convenient, in presenting such notes as are here necessary on the various coal-bearing areas of the Province, to begin with those of the Cretaceous period, and this order

* See Report

is further rendered appropriate by the relative importance of the fuels of that age. As most of the coal-fields are described at length in one or other of the reports of the Geological Survey, to which reference may be made, it is not intended here to enter into details with respect to them.

Principal Coal-fields (Cretaceous).

The most northern Cretaceous coal-field of the coast is that of the Queen Charlotte Islands. It extends over parts of Graham and Moresby Islands, on both sides of Skidegate Inlet, and is believed to run across the first-named island to the outer or ocean coast, though as yet only partially explored. Its area is considerable, and it has been in part geologically examined and mapped by the late James Richardson and by the writer.* In the vicinity of Skidegate Inlet, the Cretaceous rocks containing the coal are made up of the following subdivisions, in descending order.—

	<i>Fet.</i>
A. Upper shales and sandstones.....	1,500
B. Conglomerates	2,000
C. Lower shales and sandstones	5,000
D. Agglomerates (of volcanic origin)	3,500
E. Lower sandstones	1,000
	13,000

The coal, so far as known, is confined to the base of the Lower shales and sandstones (C), and is proved by its associated fossils to be approximately of the age of that member of the Cretaceous formation known as the Gault.

At Cowgitz, in Skidegate Inlet, the Queen Charlotte Coal Mining Company, about 1871, constructed a wharf, houses, tramway, etc., and attempted to work the coal-seams, which have there the character of anthracite, but met with difficulties in following the seams, of which some portions were also found to be in a crushed and pulverulent state. Though these efforts were not attended with success, the work was not carried far enough to prove that the coal in this vicinity is not of a workable character. Further exploration appears to be fully justified by what is known of the place, and I believe that work of this character is at the present time in progress. The beds containing the anthracite here are almost vertical, and it is evidently on account of the disturbance and local alteration which it has suffered that the coal has passed into the condition of anthracite. The best seam found, had a maximum thickness of a little over six feet, while a second out-crop showed two feet five inches, and other less important out-crops also oc-

* See Report of Progress Geol. Surv. Can., 1878-79.

cur. Mr. Richardson was originally of opinion that several distinct seams exist at this place, but it now appears more probable that the various out-crops represent a single seam, repeated by folding.

Analysis of
Anthracite.

In composition, the anthracite of the Queen Charlotte Islands compares favorably with that from Pennsylvania. The following analyses by Dr. Harrington* were from samples collected by Mr. Richardson; No. 1 being from the six-foot seam; No. 2 from the so-called three-foot seam (2 feet 5 inches).—

	I.	II.
Water	1.60	1.89
Volatile combustible matter.....	5.02	4.77
Fixed carbon.....	83.09	85.76
Sulphur.....	1.53	0.89
Ash	8.76	6.69
	100.00	100.00

Bituminous
coal on
Ya-koun River.

Further north, in the same Cretaceous area, on the Ya-koun River, about midway between Skidegate and the head of Masset Inlet, a discovery has lately been made of bituminous coal of excellent quality. The bed is reported to be a very thick one, (18 feet), and several tons of the coal have been brought out, and tested with favorable results. Means of communication with the coast must, however, be provided before this deposit can be utilized. It is not certainly known whether this coal occupies the same position in the Cretaceous series as that of Cowgitz, but it is very probable that it does so.

Analysis.

The character of this coal is shown by the following analysis by Mr. Hoffmann.†—

Hygroscopic water.....	2.65
Volatile combustible matter.....	30.59
Fixed carbon.....	61.33
Ash	5.43
	100.00

Coal-fields of
Northern
Vancouver
Island.

In the northern part of Vancouver Island, the Cretaceous coal-bearing rocks, though occupying but a small portion of the surface as compared with the older formations, have in the aggregate a considerable extent. The principal areas are those of Forward Inlet, Koprino and Koskeemo, all on the shores of Quatsino Sound, and of Suquash, on the north-east coast of the island. Of the Quatsino Sound areas, the only one which has yet attracted much attention is that referred to as the Koskeemo, which is situated on the upper part of Quatsino Sound. In this area, some exploration, both by sinking and boring, has at

* Report of Progress, Geol. Surv. Can., 1872-73, p. 81.

† Annual Report, Geol. Surv. Can., 1887, p. 17 r.

* Part B, p. 1.
† See Annual
‡ Ibid. p. 87.

various times been carried out, though so far without resulting in the discovery of a coal-seam of a satisfactory workable character; the greatest thickness of good coal yet proved being about three feet only. The total length of this small Cretaceous area is about seven miles, its greatest probable width about two miles, and its approximate area, not including under-water extensions, about 5630 acres. Particulars respecting this area, with a map and details of borings, etc., may be found in the annual report for 1886.* The coal is bituminous, and is often of excellent quality. An analysis of a specimen, made in the laboratory of the Survey, gives the following result.—

Hygroscopic water.....	1.05	Analysis.
Volatile combustible matter.....	34.38	
Fixed carbon.....	54.01	
Ash.....	10.56	
	100.00	

In the Forward Inlet Cretaceous area, coal is found at the head of Forward Inlet, the lagoon above Winter Harbour, but much disturbed locally and thin. It is not improbable, however, that boring operations on Winter Harbour would result in the discovery of better seams.† It appears likely that this area really connects eastward with that of Koprino, Koprino, which extends along the north shore of the lower part of Quatsino Sound for seven or eight miles, and has a considerable width. Though no coal has yet been found in the last-mentioned area, it is larger than either of the others on Quatsino Sound, and as the beds are regular and little disturbed, it may, on proper investigation by boring, prove to be the most important.‡

The coal-field referred to as the Suquash area, extends along the north-east coast of Vancouver Island from Port McNeill to Beaver Harbour, a distance of fourteen miles. Its width inland must be considerable, and it probably also includes Malcolm Island, to the eastward, of which the surface is almost entirely covered by drift deposits. The original discovery and early exploration for and working of coal at this place are elsewhere referred to, (p. 80 R). The coal-seams as yet found here are quite thin, the thickest, at Suquash, not exceeding two feet. In consequence, however, of the flat-lying position of the beds along the shore, the exposures are poor, and but a small part of the thickness of the Cretaceous rocks is shown. The regularity of the beds and their extent are favourable to mining operations should thicker seams be discovered by boring. Particulars respecting this

* Part B, p. 90 B., *et seq.*

† See Annual Report Geol. Surv. Can., 1886, p. 83 B.

‡ *Ibid.* p. 87 B.

district are to be found in the report already referred to.* The coal found at Squash is of very fair quality, as evidenced by the subjoined analysis.—

Analysis.	Hygroscopic water.....	5.03
	Volatile combustible matter.....	41.51
	Fixed carbon.....	46.52
	Ash.....	6.94
		100.00

Relative age of the coals. Respecting the stratigraphical position of these coal-bearing Cretaceous rocks of the northern part of Vancouver Island, it may be stated that the coals of Quatsino Sound generally, are believed to occur at the same horizon with those of Cowgitz, or in Series C, of the Queen Charlotte Islands section, while those of Squash appear to belong to a higher stage.

Reports on Nanaimo and Comox. The Comox and Nanaimo coal-fields are the most important in the Province, and the latter is that from which almost all the coal so far raised has been obtained. They have been in large part carefully examined by Mr. Richardson, whose various reports in the annual volumes of the Geological Survey for 1871-72, 1872-73, 1873-74 and 1876-77,† may be consulted for details.

Coal fields of Southern Vancouver Island. The Cretaceous rocks constituting these coal-fields, border the southwestern side of the Strait of Georgia, forming a belt of comparatively low, rolling or hilly country between the mountainous region of the interior of Vancouver Island and the coast. This belt, including the Cowichen area, reaches to within about eighteen miles of Victoria to the south-eastward, and to the vicinity of Cape Mudge in the opposite direction, with a length on the shore of about 130 miles. Its continuity is broken however at two points, near Maple Bay and near Nanoose Harbour, respectively, where the older underlying rock-series comes out to the shore. Beyond Cape Mudge, it runs inland in the same general north-westward bearing, but its extent in this direction is still unknown.

Stratigraphical relations. The rocks accompanying the coals are sandstones, conglomerates and shales, being largely of the character of littoral formations, but also containing, (particularly in the shaly members of the series) truly marine fossils. They hold also in some layers abundance of fossil plants, and in appearance and degree of induration much resemble the older Carboniferous rocks of some parts of Eastern America. Coals of a workable character have been found only in the

* Annual Report Geol. Surv. Can., 1886, p. 61 n.

† In the last-named report, a general review of the geology is given. See also Annual Report Geol. Surv. Can., 1886, p. 16, n.

lower part of the Cretaceous series, which is represented with closely similar characters in the Comox & Nanaimo areas. The somewhat variable character of the Cretaceous measures as a whole is, however, shewn by the fact that Mr. Richardson found it necessary to adopt a different scheme of sub-divisions for the two areas, notwithstanding their general correspondence. The sections at Comox & Nanaimo are as follows, in descending order.—

Sections at
Nanaimo and
Comox.

COMOX.	<i>Feet.</i>	NANAIMO.	<i>Feet.</i>
Upper conglomerates.....	320	Sandstones, conglomerates and shales.....	3290
Upper shales.....	776		
Middle conglomerates.....	1100		
Middle shales.....	76		
Lower conglomerates.....	900		
Lower shales.....	1000	Shales.....	660
Productive coal-measures...	739	Productive coal-measures....	1316
	4911		5206

The age of the Productive Coal-measures of Nanaimo & Comox is approximately that of the Chico group of California, in which, however in its typical locality, coals are not found.

The Comox area has probably a greater extent of productive measures and may eventually become more important than the Nanaimo. Mr. Richardson gives a number of carefully measured sections of the Comox area,* shewing its character along various parts of a line, which, following the direction of the out-crop of the beds, is about thirty miles in length. On Brown's River, furthest north, almost the entire mass of the Productive Measures is exposed, with a thickness of 739 feet 6 inches of beds. In this section, nine coal-seams occur, with an aggregate thickness of 16 feet 3 inches, the thickest bed being the lowest in the series, and averaging 7 feet. In a section of 122 feet at the Union mine, ten coal seams, with an aggregate thickness of 29 feet 3 inches occur, the thickest seam being 10 feet. This section represents only a small part of the Productive Measures. In a third section, on Trent River,—again embracing nearly the entire thickness of the Productive Measures,—thirteen seams are found, with an aggregate thickness of only 18 feet 1 inch, the thickest bed being 3 feet 8 inches. On the area of the Baynes Sound Company, in 220 feet 10 inches of measures, two seams of 6 feet and 5 feet 10 inches, respectively, occur.

Mr. Richardson estimates the extent of country underlain by the Productive Measures at 300 square miles, without taking into consideration that which may lie beyond the shore, and not including the unexplored north-western extension of the field previously referred to.

Extent and
value of this
field.

*Report of Progress, Geol. Surv. Can., 1872-3, p. 85 *et seq.*

Computing the total thickness of workable coal in the Union Company's property at a little over twenty-five feet, he calculates the quantity of coal underlying the surface at 25,000 tons per acre, or 16,000,000 tons per square mile for this part of the region.*

The operations now in progress in opening up mines in the Comox area have been alluded to on a former page. The principal seam which it is intended to work has been proved, by boring, to continue with good thickness for at least two miles in length.

Character of
Comox coals.

The quality of the Comox coals is equal, if not somewhat superior to that of those of Nanaimo. They contain but a small percentage of water and the ash is also often very low. Several of them yield strong cokes. Proximate analyses of representative specimens are quoted in the table at the end of this chapter (p 98 R). The following analysis by Dr. B. J. Harrington may be quoted here, as probably representing the character of the main seam now being opened out for work. It is of that which Mr. Richardson named the lower or ten-foot seam, which shewed, where he examined it in the natural section, 7 feet 6 inches of clean coal.†—

	Slow coking.	Fast coking.
Hygroscopic water.....	1·70	1·70
Volatile combustible matter....	27·17	32·36
Fixed carbon.....	68·27	63·08
Ash.....	2·86	2·86
	100·00	100·00
Coke	71·13	65·94

Nanaimo
coal-field.

The area of the Nanaimo coal-field is estimated at about 200 square miles. There are at least two distinct seams of workable thickness in this area, but in consequence of folds and faults it is not easy to fix the equivalency of beds in its various parts. Three collieries are at present in operation here, the Nanaimo, Wellington and East Wellington. The works of the two first-named are on a very extensive scale, embracing numerous shafts and inclines, provided with good machinery, railways and wharves. In the Vancouver colliery, the principal workings are upon a seam which averages from six to ten feet in thickness. A second seam, overlaying the last, and separated from it by 140 feet of sandstone, is seven feet thick. The seam worked in the Wellington colliery averages about nine feet in thickness, and yields a rather dry steam coal which does not afford a strong coke. The coal from the Vancouver colliery, on the contrary, gives a good coke and produces a large quantity of illuminating gas

*Report of Progress Geol. Surv., Can., 1871-72, p. 80.

†Report of Progress Geol. Surv. Can., 1872-73, pp. 38, 76.

Several proximate analyses are summarized in the table at the end of this chapter. That of the Wellington coal by Mr. C. Hoffmann, may be quoted here in full, as illustrating the character of the larger part of the coal shipped.—*

Character of
Nanaimo coals.

	Slow coking.	Fast coking.
Hygroscopic water	2.75	2.75
Volatile combustible matter	30.95	38.03
Fixed carbon	59.72	52.64
Ash	6.58	6.58
	100.00	100.00
Coke	66.30	59.22
Weight of one solid cubic foot	82.64 pounds.	
Evaporative power, 13.41 pounds of water (at 100° C.) per pound of fuel.		

Besides the coal-fields above described, Cretaceous coal-bearing rocks are known to occur in several additional places upon the shores of Vancouver Island. Mr. Richardson describes the occurrence of rocks of the coal series at the head of Alberni Canal which opens into Barclay Sound, and coal has been found in other localities on the west coast in the vicinity of Clayoquot Sound. The interior of the island being yet comparatively unknown, even geographically, it is not improbable that a geological examination may bring to light coal areas in the valleys and tracts of low country which may prove to be important. A great part of the folding which the rocks have experienced is of post-Cretaceous date, a fact which renders it quite possible that outlyers of the coal-bearing rocks may be found folded into other synclinals besides these already known along the coast-line.

Other
coal-fields in
Vancouver
Island.

The character of the coals of Vancouver Island is illustrated by the analyses already quoted and by those in the comparative table (p. 98 R). Their superiority for all practical purposes to any others worked upon the Pacific Coast may be regarded as demonstrated, and is particularly evidenced by the higher price which they command, and by the fact that they are largely exported to California, and compete there successfully with coal produced in the United States, though handicapped by a duty of 75 cents a ton.

General
composition of
Vancouver
Island coals.

Dr. B. J. Harrington gives, as representing the average composition of the coals of Vancouver Island, as deduced from fifteen analyses by himself and Dr. T. S. Hunt, (chiefly from Nanaimo and Comox) the following.—†

* Report of Progress Geol. Surv. Can., 1882-84, p. 37 M.

† Report of Progress Geol. Surv. Can., 1872-73, p. 79.

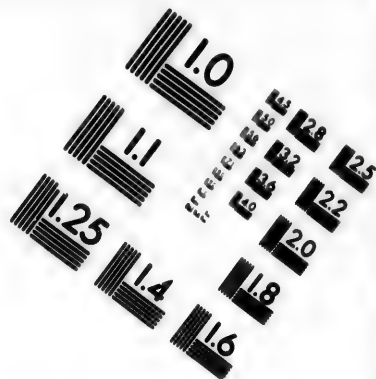
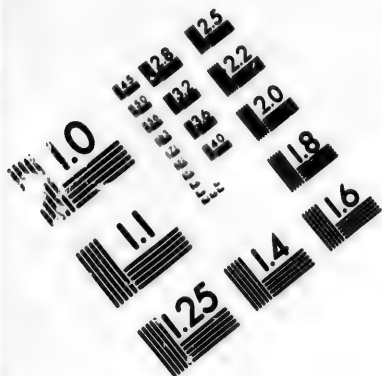
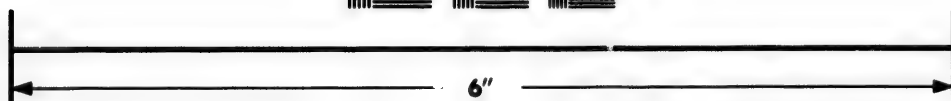
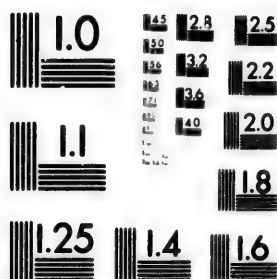


IMAGE EVALUATION TEST TARGET (MT-3)



**Photographic
Sciences
Corporation**

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
7.1
8.0
9.0
10.0
11.2
12.5
14.0
16.0
18.0
20.0
22.5
25.0
28.0
31.5
36.0
40.0
45.0
50.0
56.0
63.0
71.0
80.0
90.0
100.0

10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100

Total volatile matter.....	30.33
Fixed carbon.....	60.23
Ash.....	9.44
	100.00

Coals of Puget
Sound.

Though numerous analyses of picked samples from mines in the vicinity of Puget Sound, in Washington Territory, can be quoted, which compare favorably with those of Nanaimo, the fact remains that those actually shipped in quantity from Puget Sound points hold a distinctly inferior market value. This may in part be due to the large quantity of ash which these fuels often contain, a fact well illustrated in the tables of analyses in the U.S. Tenth Census.* On Puget Sound the greatest quantity of coal is shipped from Seattle and this ranks only as a lignite-coal affording no coherent coke. Of the following analyses representing the character of the Seattle coal, the first is quoted by Mr. Bailey Willis in the Census Report just cited,† the second is that given by Macfarlane.‡—

	I.	II.
Water	4.16	11.66
Volatile combustible matter.....	44.84	35.93
Fixed carbon.....	43.86	45.97
Ash.....	7.14	6.44
	100.00	100.00

Relative values
of West Coast
fuels.

As an impartial estimate showing the superiority of the Vancouver Island coals, the following table establishing the comparative value of these and other fuels for steam-raising purposes, by the War Department of the United States, will be interesting.

One cord (8 feet by 4 feet by 4 feet) of merchantable oak wood is there said to be equal to:—

	Pounds.
Nanaimo Coal (Vancouver Island).....	1,800
Bellingham Bay Coal (Washington Territory).....	2,200
Seattle Coal (Washington Territory).....	2,400
Rocky Mountain Coal (Wyoming, &c).....	2,500
Coos Bay Coal (Oregon).....	2,600
Mount Diablo Coal, (California).....	2,600

The following statement of the weights of steam obtained as the result of working tests from a cubic foot each of various fuels, at a slow rate of combustion, may also be referred to. The water to be evaporated had first been raised to a temperature of 212° F. The experiments

* U.S. Tenth Census, vol. xv, pp. 776-780.

† p. 761.

‡ Coal Regions of America, Third Edition, p. 569.

On
believe
Island
has be

• Ex. I
Ann

were made by the Chief Engineer of the U. S. Navy Yard at Mare Island.*—

	Pounds of Steam.
Nanaimo coal.....	372·64
Rocky Mountain, Monte Diablo, Coos Bay and Seattle	319·98

Though rocks of Cretaceous age occur on the mainland of British Columbia, and especially in the little-known northern portion of the Province characterize extensive tracts, they have not generally been found to contain coal. It may be stated, however, that specimens of good coal have been obtained from these rocks in the region of the Upper Skeena, (p. 150 R) on the western, or British Columbian side of the water-shed in the Rocky Mountains in the vicinity of the Crow Nest Pass, and in the country adjacent to the Peace River; and that it is probable that many further discoveries of the same kind still remain to be made.

Cretaceous
coals on the
Mainland.

The coals of the Crow Nest Pass, first described by the writer in the Annual Report of the Geological Survey for 1885, (p. 69 R) have since attracted some attention, and have been to some extent explored and opened up. The Cretaceous basin or trough in which they occur is somewhat extensive, and resembles in general character those which occur on the opposite side of the Rocky Mountain water-shed, beyond the limits of British Columbia, in one of which the Cascade anthracite is included. The age of these Cretaceous rocks appears to be nearly the same with that of those of the Queen Charlotte Islands. By the 'prospecting' work which has lately been executed in the Crow Nest Pass, the existence of no less than fifteen workable seams is said to have been determined, two of which are reported as fourteen and thirty feet respectively in thickness (see p. 97 R). An analysis of coal from the thickest of these, (known as the "Jubilee Seam") by Mr. Hoffmann gave:—†

Coals of Crow
Nest Pass.

Hygroscopic water.....	1·70
Volatile combustible matter.....	25·45
Fixed Carbon.....	69·14
Ash.....	3·62

100·00

On the Upper Skeena and its tributaries, Cretaceous rocks, again believed to be of the same age with those of the Queen Charlotte Islands, are extensively developed. One specimen of excellent coal has been obtained from them, at a place about eighteen miles up the

Coal-bearing
rocks of
Skeena.

* Ex. Doc. No. 206. 2nd Session, 42nd Congress. p. 30.
Annual Report Geol. Surv. Can., 1887, p. 12 r.

Watsonkwa, and impure coals have been noted in several localities. It is by no means improbable that an extensive coal-field exists here.*

Coals on Peace
River.

To the north of the 54th degree of latitude, the eastern boundary of British Columbia follows the 120th meridian, and the Province therefore, includes a portion of the coal-bearing region of the Peace River. Here, mineral fuels are known to occur at two distinct horizons, one being well down in the Cretaceous series, the other probably of Laramie age. Some of the fuels are true bituminous coals and others lignite-coals. The limited amount of exploration yet carried out has not resulted in the discovery of any very thick seams to the west of the 120th meridian, but the region is still, for the most part, practically unknown in detail.†

Coal and Lignite of the Tertiary.

Tertiary fuels.

The Tertiary rocks of British Columbia occasionally contain true coal, but more usually afford only brown-coal or lignite. Most of these rocks, as already noted, are assigned with probability to the Miocene period, but some of them, particularly those of the vicinity of the Fraser estuary, may be referable to the Laramie, to which stage the greater part of the coal- and lignite-bearing rocks of Puget Sound are now presumed to belong. ‡

Fuels of Puget
Sound, etc.

At Bellingham Bay, a short distance south of the International boundary, lignite was discovered about 1851, and in 1869, 20,500 tons were shipped to San Francisco, but the mines were closed down, owing to the inferior quality of their product, in 1878. Lignite-coals of the same age, or but little older, are now very extensively worked, however, in the vicinity of Seattle, and in the Wilkinson coal-field, further southward, as well as to the eastward, near the borders of the Puget Sound coal region, where the better classes of fuels previously adverted to occur. Some of these are, however, probably referable to beds older than the Laramie or of true Cretaceous age.

Fuels of
Burrard Inlet
and Lower
Fraser.

The interest of these facts, in the present connexion, lies in the circumstance that the Tertiary or Laramie coal-measures of Puget Sound and Bellingham Bay are continuous north of the International boundary, and must underlie nearly 18,000 square miles of the low country about the estuary of the Fraser and in the lower part of its valley. Lignite has been found in association with these rocks at Burrard Inlet and other localities, and specimens of a fuel resembling true bituminous coal (and coking on the

* Report of Progress Geol. Surv. Can., 1879-80, p. 101 n.

† See Report of Progress Geol. Surv. Can. 1879-80, p. 134 n.

‡ See Report of Mr. Bailey Willis, U.S. 10th Census. vol. xv, p. 769. Also Dr. C. A. White on the Puget Sound Group, Am. Journ. Sci., vol. xxxvi. Dec., 1893.

application of heat) have been obtained near the Fraser above New Westminster. The remarkably good specimen of coal from the River Chilliwack, of which an analysis, by Dr. Harrington, is given on page 99 of the Geological Survey Report for 1873-74, is probably from this series. The seams yet discovered are quite thin, but the low country underlain by the formation is deeply covered with drift and alluvium, and exposures are few; so that boring operations will be necessary before the existence or otherwise of workable seams of coal or lignite can be demonstrated in this region. Some particulars bearing on this problem, by Mr. Amos Bowman, may be found in the Summary Report of the Geological Survey for 1888 (p. 8), and notes on the more important localities are given at some length on a later page of present report (p. 147 R).* The thickness of Tertiary rocks of which more or less complete exposures occur, is estimated at about 3000 feet.

As probably indicative of the character of some of the fuels to be found in the Lower Fraser region, the following analysis of that of Bellingham Bay may be quoted. †—

Value of these
fuels.

Hygroscopic water.....	8.39
Volatile combustible matter.....	45.50
Fixed carbon.....	33.26
Ash.....	12.86
	100.00

If fuels of this character, in beds of workable thickness, should be found to occur in the strata underlying Vancouver or New Westminster, the time has now arrived when they might be utilized on a large scale for local purposes, even though not so well suited as the coals of Nanaimo and Comox for purposes of export.

Tertiary rocks holding lignite are found fringing other parts of the coast in greater or less width. They occur near Sooke,‡ and at various places on the south-west coast of Vancouver Island, and form a large part of the northern portion of the Queen Charlotte Islands. Particular references to the principal places in which lignite is found, are given on a later page (p. 145 R), but with the exception of the Lower Fraser region, none of these localities can be considered as of present importance, in view of the existence and accessibility of the superior fuels of the Cretaceous.

Lignites of the
Coast.

Rocks of Tertiary age are known to cover great tracts of the interior of British Columbia, and it can now be shown that in most places the horizontal, or slightly-inclined basaltic and other igneous flows of the

Tertiary coal-
and lignite-
bearing rocks
of the Interior.

* See also Report of Progress Geol. Surv. Can. 1876-77, p. 188.

† Coal Regions of America, Macfarlane. Third Edition, p. 577.

‡ Report of Progress Geol. Surv. Can. 1876-77, p. 190.

interior plateau, are attached to, and form the latest rocks of the lignite- or coal-bearing series of the Tertiary. From this fact, and the known relations of the beds in a number of localities, it is highly probable that sedimentary Tertiary deposits underlie a great part of the area, where only the later igneous rocks are seen at the surface, and in many places where extensive exposures of these Tertiary deposits occur, more or less coal or lignite has been found in association with them. Very roughly, in our present comparatively slender knowledge of the region, it may be estimated that this formation occupies between the 54th and 49th parallel of latitude, an area not less than 12,000 square miles.

Nicola River
and Coldwater.

In the Nicola Valley, near the mouth of the Coldwater, the occurrence of coal has been known for some years. The average of two determinations, by Dr. Harrington, gave the following result.—*

Volatile combustible matter and moisture.....	36.065
Fixed carbon.....	61.290
Ash.....	2.645
	100.000

The seam from which the above specimen was derived, has a thickness of nearly five feet, and is the lowest exposed. Other seams occurring higher in the series approach lignites in composition. The rocks containing these fuels are chiefly yellowish sandstones, which pass beneath massive volcanic accumulations, and are not well exposed except in the vicinity of the mouth of the Coldwater, though the overlying volcanic series extends along the Nicola to its confluence with the Thompson, or for about thirty-seven miles. This locality is the most promising one yet found in connexion with the Tertiary of the Interior. Similar rocks to those here containing the coal are also found to extend far up the Coldwater, and though not satisfactorily exposed, are known to contain more or less coal.†

Kamloops and
Thompson
River.

The lower beds of the Tertiary are again found to contain coal at a place within three miles of Kamloops. The fuel is of a bituminous character and of good quality, but the seams so far found are less than a foot in thickness. Coal also occurs in the same position, about forty-five miles up the North Thompson, but here again the seams yet discovered are thin.‡

* Report of Progress Geol. Surv. Can., 1876-77, p. 465. Another analysis made from specimens subsequently collected is given in the table. (p. 98 B.)

† See Report of Progress, Geol. Surv. Can., 1877-8, p. 123 B.

‡ Summary Report Geol. Surv. Can., 1888, p. 4. Report of Progress, Geol. Surv. Can., 1877-78, p. 113 B.

Lignites or brown-coals are found abundantly in other parts of the Tertiary formation. On Hat Creek, near Marble Cañon, a bed of this material surpasses forty feet in thickness, and important deposits also occur on the North and South Forks of the Similkameen. The lignites and lignite formation of Quesnel are described in the reports of the Survey,* but the lignites here are, I believe, of no economic value. They are mixed with clayey matter, and are otherwise poor in quality; and are, apparently, the result of the rather tumultuous deposition of drift-wood and other vegetable matter, by rapidly-moving waters. Lignite of better quality, and apparently, in some instances at least, still resting in the locality where the wood producing it grew, is, however, found in other places, which are enumerated on later pages.

Other localities
of lignites.

These lignites do not, of course, compare favorably as fuels with the coal of the Nicola valley or with those of the Cretaceous, and would scarcely be of value, unless found in thick and accessible seams, and then only for local use or in the absence of other fuels. Comparatively little is yet known about their distribution, for though, as already stated, they probably underlie a great part of the basaltic plateau, the soft character of the associated beds allows them to be easily worn away, leaving hollows into which the basalts and other hard overlying volcanic rocks, readily crumbled by the weather, fall, concealing the lignite out-crops.

Value and
extent of
lignites.

The subjoined table of proximate analyses gives, in summarized form, the results of a number of examinations of British Columbian coals and lignites. The references are to the published reports of the Geological Survey, where additional particulars with respect to these fuels may be found. The analyses selected are almost exclusively those of worked or workable seams. They shew, as already mentioned, that the fuels of the Province as a whole include all varieties, from anthracite to lignite, and that many of them are of a very high class.

Table of
analyses.

Analysis No 15 represents a fuel from a group of seams of the same character, lately discovered in the coal-bearing series of the Crow Nest Pass. The seams are reported to run from 4 to 7 feet in thickness. The specimen of which the assay is quoted, yields no less than 57.71 per cent. of volatile combustible matter by fast coking, resembling a true cannel in its behaviour on heating, and constituting a very excellent gas coal.

Gas-coal.

*See Reports of Progress, Geol. Surv., Can., 1877-78 pp. 121 n., 130 n., 132 n.; 1871-72 p. 58; 1877-78 p. 257.

TABLE OF PROXIMATE ANALYSES OF COALS AND LIGNITES FROM THE PROVINCE OF BRITISH COLUMBIA.

	LOCALITY. (<i>Ordovician</i> .)	By slow or fast cooking.	Hygroscopic moisture.	Volatile combustible matter.	Fixed Carbon.	Ash.	REFERENCE.
1	Cowgitz, Queen Charlotte Islands. "Six-foot seam".	2	1.60	6.55	83.09	8.76	1872-73 p. 81.
2	Ya-Koon River, between Skidegate and Masset Inlets, Queen Charlotte Islands.	2	2.65	20.59	51.33	5.43	1867 p. 17 t.
3	Sool Harbour, Kootenai.	2	1.05	31.38	54.01	10.56	1867 p. 16 t.
4	Squash, N.P. Coast of Vancouver Island.	2	0.61	41.51	46.32	6.94	1867 p. 19 t.
5	Front River, Comox. 4 ft. 5 in. seam.	2	0.37	38.19	57.72	2.83	1872-73 p. 77.
6	Union Chain, Comox. 4 ft. seam.	2	1.34	28.17	67.72	2.66	1872-73 p. 77.
7	Union Chain, Comox. 7 ft. 6 in. seam.	2	1.70	27.17	68.22	2.66	1872-73 p. 77.
8	Baynes Sound Mine, Comox. Richardson seam.	2	1.18	31.13	48.51	16.18	1878-79 p. 468.
9	Wellington Mine, Departure Bay, Nanaimo.	2	2.75	30.95	59.72	6.58	1882-84 p. 37 m.
10	Upper seam, Nanaimo.	2	2.30	30.30	55.75	14.95	1871-72 p. 92.
11	Newcastle Island, Nanaimo. Upper seam 3 to 4 ft.	2	1.57	31.77	58.03	8.63	1872-73 p. 80.
12	Newcastle Island, Nanaimo. Lower seam 4 ft.	2	1.30	35.45	52.57	11.94	1871-72 p. 90.
13	Peter's Creek, Nanaimo.	2	1.70	35.45	52.57	11.94	1871-72 p. 90.
14	Jubilee seam, Crow Nest Pass.	2	1.83	24.88	68.94	4.37	1837 p. 14 t.
15	Seam X, Crow Nest Pass.	2	2.10	44.41	43.63	9.86	1878-79 p. 14 m.
16	Watson's R., 18 miles above Skeena Forks.	2	0.85	39.67	57.51	1.97	1878-79 p. 14 m.
17	The Cañon, Peace River.	2	2.10	21.54	71.63	4.73	1875-76 t. p. 70.
18	Pine River, five miles above the Lower Forks, Peace River District.	2	2.45	27.87	51.56	15.10	1882-74 o. 39 m.
(Tertiary or Larvianic.)							
19	Near Chilliwack R., about 5 miles from Fraser R.	2	55.73	20.65	63.96	0.41	1873-74 p. 92.
20	Month of Coldwater River. Fifteen-foot seam.	2	4.45	20.65	57.16	8.71	1875-77 p. 468.
21	Month of Coldwater River. Fifteen-foot seam.	2	5.78	20.65	53.69	13.68	1875-77 p. 468.
22	Upper Nechaco, South of Fort Fraser. Four-foot seam.	2	10.46	35.01	44.84	4.89	1876-77 p. 467.
23	Kohaganako Stream, South of Tanyabankut L. Four-foot seam.	2	9.90	37.71	38.83	13.54	1876-77 p. 467.
24	N. Thompson, 45 miles above Kamloops.	2	2.84	33.56	52.01	11.57	1876-77 p. 466.
25	Hat Creek. Forty-foot seam.	2	8.60	33.51	46.84	9.05	1877-78 p. 47 o.
26	Lowes River. Lot 65° 15' Long. 130° 25'	2	6.03	36.92	49.03	8.02	1867 p. 11 t.

*See re
Progress,
† For de
Burr. Can
U. S. 7

IRON.

Comparatively little attention has yet been given to iron-ores in British Columbia, in consequence of the impression that under the present conditions they possess little or no value. This is no doubt the case with those which are at a distance from the sea-board and remote from means of communication, but the time should not be far distant when such deposits as lie near navigable water, by which communication with the coal-fields may be had, can be utilized extensively in the manufacture of iron.

Most of the ores of iron so far found in quantity, are magnetites, which occur in association with the older metamorphic rocks of the Province. Clay iron-stones are, however, of frequent occurrence in the coal series of Vancouver and Queen Charlotte Islands as well as in the Tertiary rocks of the Interior. These might, no doubt, in some cases, be profitably worked in conjunction with the coal-seams, as they occur in the same strata, and in some instances are even associated with the coal. The nodules vary in weight from a pound or less up to several tons, and Mr. Richardson says that at the Baynes Sound mine, a sufficient quantity might probably be obtained for the regular supply of a blast furnace.*

The only iron-ore deposits which have yet been worked, are those of the south-west side of Texada Island, the largest exposures of ore occurring about three miles north-west of Gillies Bay. Here the ore-mass is seen to be from twenty to twenty-five feet thick, and constitutes a somewhat irregular contact-deposit between limestone or marble and granite, thin veins of the ore being occasionally found reticulating the limestone. From this point to the northward, for nearly a mile, the ore is occasionally seen, and at one place there is a continuous exposure about 250 feet long and from one to ten feet thick. As regards mining and shipment, the ore is most favourably situated; while in the event of smelting operations being undertaken on the spot, there is an abundance of wood suitable for making charcoal on the island, and Comox Harbour, from which the coal of the Comox area may be shipped, is less than twenty miles distant.†

The ore is a magnetite of excellent quality. A partial analysis by Dr. B. J. Harrington, in the laboratory of Survey, shewed 68.40 per cent. of iron, with only .003 per cent. of phosphorus. A partial analysis by Whitfield,‡ representing a lot of 600 tons, shews iron

* See remarks by Dr. B. J. Harrington, in Appendix iii, to Mr. Richardson's report. Report of Progress, Geol. Surv. Can., 1872-73, p. 82.

† For details see Report of Progress, Geol. Surv. Can., 1873-74, p. 99. Annual Report Geol. Surv. Can., 1886, p. 36 B.

‡ U. S. Tenth Census, vol. xv, p. 580.

65.71, phosphorus .013. A more detailed analysis carried out by Messrs. P. C. Gilchrist and E. Riley, on specimens sent to the Colonial and Indian Exhibition in 1886, is as follows.*—

Iron.....	69.85
Manganese.....	trace
Siliceous matter.....	2.75
Sulphur.....	.06
Phosphoric acid.....	trace
Moisture.....	trace

Mining of the ore.

At the principal deposit of ore, situated as above described, a wharf has been built, and excellent arrangements made for mining and shipping. The ore is brought to the wharf by an incline nearly a quarter of a mile in length, from the point at which it is quarried out, about 250 feet above the sea-level. Considerable quantities of ore have been shipped from time to time to the works of the Puget Sound Iron Company, situated at Irondale, W. T. The Texada ore is there mixed with from one-ninth to three-tenths bog-ore, found near Irondale, and produces thus, or when smelted alone, an excellent quality of foundry pig.

The shipments in 1885, amounted to 190 tons; in 1886, 3941 tons; in 1887, to 1410 tons; and in 1888 to 7300 tons, valued at \$18,400.†

East side of Texada.

Iron-ore deposits of the same character, and in considerable mass, are again found on the opposite or north-east shore of Texada Island, and very probably are more or less continuously developed along the contact of the granites and limestones elsewhere in the island.

Sooke.

Magnetic iron-ores of somewhat similar character occur in the hills to the east of Sooke Harbour, Vancouver Island. The deposits are on Sections 79 and 83, Sooke district, at a distance of about twenty miles from Victoria, near the coast, and well situated for shipment. The deposit is rather of the nature of a *stoke-work* than a true vein, but can be traced for some distance in a N.E.-S.W. direction, and in places shews from ten to twenty feet of nearly pure ore. The country-rock is a coarsely crystalline diorite (?), containing much hornblende. The following assays of various specimens of the ore give the percentage of metallic iron.—

Analyses of the ore.	Wm. Julian, San Francisco.....	72.40
	Thos. Price, " ".....	51.80
	" " " ".....	57.30
	J. T. Bernige, Cornwall.....	48.90
	" " " ".....	68.50
	J. Kestle & Co., San Francisco.....	64.50
	D. Wallace, Glasgow.....	61.50
	" " " ".....	65.00

* Journal of the Iron and Steel Institute, 1886, p. 561.

†Tons of 2240 lbs.

Magnetic iron-ore occurs in considerable mass in the Queen Charlotte Islands, on the east side of the entrance to Harriet Harbour, Skinkuttle Inlet. No attempt has, however, yet been made to utilize this ore. Occasional strings of pyrites traverse the ore, but it is, as a rule, remarkably pure. Specimens of an average character, collected by myself in 1878 and examined in the laboratory of the Survey, proved to contain 58.06 per cent. of metallic iron, while an exceptionally good fragment yielded 69.88 per cent.*

Very pure specimens of magnetite have also been brought from an island in the Walker group, in Queen Charlotte Sound, near the north end of Vancouver Island. These proved to contain 71.57 per cent. of metallic iron. Another specimen of a similar ore, comes from a deposit, which is reported to be extensive, on the north side of Rivers Inlet, about twenty-five miles up from its entrance. Numerous other localities of iron-ores will doubtless be found when sought for. Such additional occurrences on the coast as appear to be worthy of mention as well as those known in the inland portions of the Province, are enumerated further on. (See p. 151 R.)

COPPER.

Copper-ores are known to occur in many places, over the entire area of British Columbia. They were among the first to attract notice at several localities on the coast, and during the early years of the Province, various irregular and uncertain attempts were made to open up copper-mines, but none of these resulted advantageously to the promoters, and no copper mining has yet been initiated in British Columbia. Copper-ores in smaller quantity are very frequently found in little veins and joints in the altered volcanic rocks of the Vancouver series, extensively developed on the coast, as well as in the similar rocks of the interior of the Province. Hundreds of such localities have been observed, but only a small proportion of them can be considered at all promising. Such occurrences, however, should receive the attention of the prospector where met with, as the copper-staining of rock-exposures is sometimes the most obvious indication of the presence of ores of the precious metals.

It is further impossible to draw a distinct line between deposits which are to be regarded as ores of copper and those which hold sufficient gold or silver to entitle them to be classed as ores of the precious metals. In consequence of this fact, a number of metalliferous deposits which might with equal propriety have been included here, have already received mention in the pages devoted to the precious metals, to which reference should be made. Thus the Toad Mountain

*Report of Progress, Geol. Surv. Can., 1878-'9, p. 54 R.

ores, though owing most of their value to silver, contain, in specimens assayed, from 25 to 47 per cent of copper. The ores of Jubilee Mountain, on the Upper Columbia valley, are again very rich in copper, and some of them in which the percentage of silver is low, must be regarded rather as copper-ores. Copper-pyrites also occur in some quantity in the Stump Lake ores and in those of several other places previously described. A deposit of copper-pyrites which appears to be of importance, is that owned by the B.C. Copper Mining Company, on the upper part of the South Similkameen. Another discovery of grey copper-ore, reported to be extensive, has lately been made between Rock and Boundary creeks.

Howe Sound.

In the vicinity of the coast, the copper deposit which has received most notice, is situated near the head of Salmon Arm of Jarvis Inlet and between that inlet and Howe Sound. This is owned by the Howe Copper Mining Company. The ore is chiefly bornite or purple copper and the deposit is not far from the coast, but at an elevation of 3000 feet above sea-level. It was discovered about 1874, and was worked at intervals between the years 1877-83, though rather with the view of developing the property than for the actual extraction of ore for shipment. Three levels have been driven on veins which are reported to be from 2 feet 6 inches to 3 feet 6 inches in width. Assays have shewn 58 per cent of copper and 50 ounces of silver to the ton. An assay of an average specimen, in the laboratory of the Geological Survey, shewed 40 per cent of copper. The veins traverse granitic rocks like those generally met with in the Coast Ranges.

Texada Island.

Some exploratory work has also been done on a copper deposit of promising appearance situated on the north-east shore of Texada Island, at the contact of marbles with an intrusive mass of granite. The ore is copper-pyrites, mixed with iron pyrites, and much of it is of very good quality. A specimen collected by myself and submitted to assay in the laboratory of the Survey, contained in addition to copper 10·20 ounces of silver to the ton.* The mining operations at one time attempted at Skincuttle Inlet, Queen Charlotte Islands, in search of copper, do not appear to have been warranted by the comparatively small quantity of copper-ore apparent there, and led to no good result.†

Queen Charlotte Islands.**Sooke.**

A somewhat peculiar deposit of copper, upon which a shaft was sunk, was discovered near Sooke, on Vancouver Island in 1864. The copper here occurs in the native state, as thin leaves quite apparent to the eye, traversing green chloritic or diabase rock. A specimen subjected to assay, however, proved to contain but 1·02 per cent. of copper.‡

* Annual Report Geol. Surv. Can., 1886, p. 34 n.

† Report of Progress Geol. Surv. Can., 1878-79, p. 53 n.

‡ Annual Report Geol. Surv. Can. 1886, p. 19 r.

Zinc
classified
the tab

Masses of native copper have been found from time to time in various parts of the Province, and nuggets and scales of the same material have been obtained in sluices-boxes in the course of gold-mining in a number of places, occasionally in notable quantity. Native copper to the amount of half a ton, obtained in this way from Quesnel River, near the Forks, was some years ago sent down to Victoria and sold there. None of these occurrences of native copper have yet been traced to their sources, but they may very probably be derived from rocks originally of volcanic origin in beds of which copper may be found to be distributed. Native copper.

In connexion with the mining of the precious metals, the out-put of copper from British Columbia is likely before long to become considerable, and it is only a question of time till copper-ores shall be worked as such in the Province. Copper out-put

Such localities of occurrence of copper as appear to be of interest are enumerated on pages 152 R to 155 R. In this connexion the list of assays of ores of the precious metals (pp. 76 R to 79 R) should also be referred to.

LEAD.

As already explained, a large proportion of the silver-ores lately discovered and now in course of development in the Province, are argentiferous galenas, from which it is evident that so soon as these ores are extensively worked, the Province will become a lead producer to a notable extent. In consequence of the constant association of silver and lead, it has been thought best to include references to lead-ores, for the most part, under the head of silver. In the ores of Mount Stephen or Tunnel Mountain, on the Canadian Pacific Railway, and those of Hendryx Camp, on the east side of Kootanie Lake, may be mentioned as important occurrences of galena in which the value of the lead bears a considerable proportion to that of the contained silver. Both these deposits are now being opened up and shipments have already been made from the first-mentioned place to the smelter lately established at Vancouver. Deposits of galena which is not rich in silver, require to be situated within easy reach of means of transport or markets, before they can be assumed to possess any immediate value. Association of lead and silver.

ZINC.

Zinc blende is frequently found as an accessory mineral in the veins classed as those of the precious metals, as will be seen on reference to the table of assays on pp. 76 R to 79 R. No deposits of the ores of this Zinc blende.

metal which possesses economic importance as sources of zinc have, however, yet been found in British Columbia.

ANTIMONY.

Stibnite.

Several occurrences of stibnite or sulphide of antimony are known, in the southern part of the Province, which may prove to possess economic value. Antimony also occurs in small quantities, in combination, in a number of argentiferous ores, but can in such cases be regarded only as an impurity.

PLATINUM.

Localities yielding platinum.

The occurrence of platinum in association with placer gold is frequent in several parts of the Province, and is alluded to in connexion with the enumeration of localities of gold-mining, in a number of cases. (See pp. 115 R to 144 R.) The metal occurs in notable quantity in the region of the Upper Similkameen and Tulameen, in minute scales where the gold is 'fine' but increasing in coarseness to small pellets and nuggets in places where 'coarse' gold is found. Coarse grains and pellets of platinum have so far been found only on Granite, Cedar and Slate creeks, all entering the Tulameen on the south side. In certain claims on these creeks, the platinum has been found to equal half the weight of the gold obtained. It is estimated that from 1400 to 2000 ounces of platinum were obtained in this district in 1887, and about 1500 in 1888.

Character of the platinum and its value.

Though above referred to as platinum, the metal so named is alloyed with several other metals of the same class, of which osmiridium is the most abundant. Specimens of the native platinum from Granite Creek have been subjected to careful examination and analysis by Mr. Hoffmann, who states that the material "having the composition of the ore here in question would, at this present time, be worth from \$2.90 to \$3.65 per ounce, troy, in the English market." Osmiridium is employed, on account of its great hardness, for tipping the nibs of gold pens. "For this purpose it is necessary that it should be in the form of natural grains, and these are very carefully selected, the requirements being that they should be solid, compact and of the proper size and shape." This was not, however, found to be the case with that present in the platinum from Granite Creek.*

Probable source of the platinum

Platinum has very rarely been discovered in veins or otherwise in its original matrix, and in the Ural Mountains, whence the greatest quan-

* Annual Report Geol. Surv. Can., 1886, p. 87 T.

* See Minerals

titles are obtained, it is almost always found, as in the cases above cited, in association with gold-bearing alluviums. In the northern part of the Government of Perm, however, it has been noted in a few places with little or no accompanying gold, and it then appears to be derived from rocks consisting of serpentine and peridotite with talcose and chloritic schists and chromite. While there is a notable abundance of greenish, chloritic, and hornblendic schists and diabase rocks, (resulting from the metamorphism of old volcanic rocks) in the Tulameen and upper Similkameen region, and chromite and magnetite are here found in the workings in association with the platinum and gold, no peridotite or serpentine is actually known to occur. The circumstances in connexion with the occurrence of the 'coarse' platinum appear to point to the vicinity of an important mass of intrusive diorite as its point of origin. A great part of the associated magnetite is certainly derived from veins in this rock, and it seems not improbable that the platinum, and possibly also a great part of the gold of this district, may occur in scattered grains in this intrusive mass, (compare p. 128 R). Very little vein-stuff occurs in the gravels with which the platinum and gold of this region are associated.

It may be added here, that the platiniferous region of the Upper Similkameen and Tulameen, is the most important as yet discovered in North America. Mr. David T. Day states, that owing to the rise in price of refined platinum, considerable enquiry for the crude material occurred in 1887, and that in consequence of enquiries for that material instituted in the West, a total quantity of 448 ounces of platinum was purchased, this being set down as the entire yield of the United States. Part of this platinum came from various places in Oregon, but a portion is stated to have been derived from British Columbia, and doubtless, from the region here referred to, as shipments were not made from other places in which very small quantities only are met with. The average price paid for this crude platinum was, according to the figures given, about \$4 an ounce.*

Importance
deposits.

MERCURY.

It has already been stated (p. 12 R.) that no important deposits of ores of mercury have yet been discovered in British Columbia. Some pieces of cinnabar have been found in several places, and on the Homathee River and Wapta (Kicking Horse) River this ore has been found in place, but apparently in neither locality in workable quantity. Mercury is mentioned as appearing in globules in the native state in some parts of the silver-ore of Silver Peak, near Hope, and it also occurs in combination with silver in the mineral arquerite previously noted.

Occurrence of
cinnabar.

* See Mineral Resources of the United States, 1887, pp. 2, 142.

ARSENIC.

Native arsenic. Native arsenic has been noted in one locality, where it apparently occurs in considerable mass, to the west of the Fraser River, a short distance above Lillooet. Elsewhere it is known only as a relatively unimportant constituent in mixed ores.

MOLYBDENUM.

Molybdenite. Molybdenite, or sulphide of molybdenum has been observed in a number of localities, but usually in small quantities only. These localities are situated for the most part in or near the Coast Ranges. Fine specimens have, however, been brought from the head of Spuzzum Creek, west of the Fraser, which may indicate the existence of a deposit of economic importance.

STRUCTURAL MATERIALS.—*Building Stones.*

Supply of building stones. Such demand as has up to the present time occurred for building-stone in various parts of the Province, has, as a rule, been satisfied without much difficulty. It may be stated, however, as a somewhat peculiar feature, that over a great part of the Interior Plateau, the rocks have been subjected to so much stress, and have been so completely crushed and jointed in consequence of disturbance subsequent to the period of their partial or complete induration, that homogeneous stone, suitable for masonry, is there notably scarce over considerable areas.

Building stones of the coast. On the coast, building stones of excellent quality are met with in the greatest abundance. These consist of granites and granitoid rocks of the Coast Ranges, and of sandstones and freestones of Cretaceous age. Both varieties may frequently be quarried at the water's edge with excellent facilities for shipment. Marbles, suitable for purpose of construction, are also found in several places, and in situations equally advantageous.

Victoria. At Victoria, a considerable quantity of good grey granite has been obtained from the large travelled boulders, which at one time existed in abundance in the vicinity of the city. Granite from the Nelson Island quarry, Jarvis Inlet, has also been employed to a limited extent, and Cretaceous sandstone from the vicinity of Nanaimo and elsewhere has been used in considerable quantities. The greater number of the permanent structures are, however, built of brick, of fair quality, which is manufactured from a sandy clay, of marine origin, which overlies theoulder-clay to a depth of from five to fifteen feet.

In the construction of the dry-dock at Esquimalt, the greater part of the stone employed was a greenish-grey sandstone of Cretaceous age, quarried extensively for the supply of this work, on Admiralty or Salt Spring Island. For portions of the work requiring greater strength, the granite of Nelson Island was used. Stone used in dry-dock.

For Vancouver, the principal building-stone is a very excellent grey granite, quarried on the North Arm of Burrard Inlet, at the water's edge, and lightened thence to the city. Brick is, however, extensively used here and at New Westminster. It is manufactured from clays similar to those of the neighborhood of Victoria, which have like those there used, a red colour.

The granites so far met with in favorable positions for quarrying in the vicinity of the coast, are generally grey in colour and more or less hornblendic. Some excellent stones of a pinkish-grey colour (like that of Nelson Island) also occur. Most of these granites and granitoid rocks are susceptible of a high polish. No distinctively red granites of good quality have been observed in mass or quarried. Granites.

The quantity and quality of the granites of the coast region is such, taken in connexion with their accessibility, as to suggest that they may ere long become the basis of an important industry, and that they will be quarried, not alone for home use, but for export to other places less favorably situated in respect to building-stones.

The greater facility with which the sandstones of Cretaceous age may be worked, renders them more appropriate for certain classes of buildings, and from a commercial point of view, they may be regarded as at least equally important with the granites. Among the coal-bearing rocks of Newcastle Island, Nanaimo, there are beds of brownish-grey sandstone, which afford excellent material for building and flagging. The upper beds are of the best quality, and it was from one of these that Mr. E. E. Emery, of San Francisco, obtained the stone for the construction of portions of the mint in that city. Blocks for pillars were taken out, which, after dressing, were twenty-seven feet six inches in length, and three feet ten inches in diameter. Flagstones, with even surfaces, as much as ten feet square, have also been obtained, and are easily quarried. These sandstones have also been employed for the manufacture of grindstones to a limited extent, and some beds are believed to be well suited for this use. Sandstones.

The marbles of Texada Island and of other localities easily reached by sea, must also be regarded as possessing considerable value for ordinary building purposes. Several of these take an excellent polish, and are already in use, to a small extent, for the manufacture of monuments. The known marbles generally range in colour from grey to white, and include some very handsome mottled and clouded varieties. Marbles.

So little enquiry has, however, yet been made for marble, that it is highly probable that many additional varieties remain to be found.

Building stones
of the interior.

Building-stones situated at a distance from the coast or from the line of railway must, of course, be considered as possessing no present value. On that part of the railway which traverses the Coast Ranges, as far inland as North Bend, grey granites of the kind just noted, and well situated for quarrying, are of frequent occurrence. Granites of this character, obtained in the immediate neighborhood, were employed in the construction of the piers of the great cantilever bridge across the Fraser. Further inland, building-stones of good quality are seldom met with near the railway, till the Shuswap Lakes are reached, but it would appear that the silts abundantly developed in banks along the rivers, and forming the latest deposit of the glacial period, are well suited for the manufacture of brick.

Quarries.

On a subsequent page a number of localities are enumerated in which quarries have been opened, or which present all the conditions necessary for the successful quarrying of good stone. In this list, special prominence is given to the southern part of the coast of the Province and to places on the line of railway. It may indeed be stated that localities not included in one or other of these categories are omitted, as, with rare exceptions, such cannot be regarded as of any immediate value.

Slate.

The existence of slate of good quality and easily fissile in large surfaces, has not, so far as I am aware, yet been proved in any part of the province of British Columbia, though reported in several places, particularly at a place six miles and a half east of Golden, on the C. P. Ry. line.

Ornamental Stones.

Materials
susceptible of
high polish.

Under the head of ornamental stones, such materials as are susceptible of employment in architecture for decorative purposes may be classed. These would include many of the granites and granitoid rocks susceptible of a high polish, together with the marbles, previously referred to. Porphyries, diorites, etc., may also be included here, and these are found in great variety of colour and texture in various parts of the Province. Slabs of a porphyrite-breccia obtained by Mr. Richardson in the Ballinae Islands were found to take a very fair polish, but few experiments have yet been made toward the utilization of such materials. The serpentines which occur in many places in the interior of the Province, can scarcely be regarded as of value for such purposes, as most of them are too much jointed and disturbed to afford blocks or slabs of useful size, free from flaws. They differ in this respect very markedly from the serpentines of the Eastern Township of the province of Quebec, some of which afford excellent verd-antique

Imp
ity an
occurs
from S
stone
it is g
derives
In this
the fac
charact
quite un
by water
proximi
be an e
places fo
Malaspin
Marshall
As en
Ranges
ble to en
througho
to mentio
ation are
own notic
Hydrau
yet been
sequence
such mate
rocks, con
the Cretac
dance, app
deserve to
It is hig
age, met w
found of v
to the trass
or the Pozz
mixed, with
and are the
Most of th
are situated

Limes and Cements.

Importance attaches also to places in which limestone of good quality and well situated for the manufacture of lime and its shipment ^{Sources of supply.} occurs. Victoria is at the present time chiefly supplied with lime from San Juan Island, W. T., and from Saanich; for though limestone occurs in several places in the immediate vicinity of the city, it is generally of an impure and siliceous character. Vancouver also derives the greater part of its supply from the San Juan quarries.

In this connexion, I think attention cannot be too strongly drawn to ^{Opportunity for work.} the fact that pure and excellent limestone, which often assumes the character of marble, occurs in the northern part of Texada Island in quite unlimited quantity, and that this island is scarcely less accessible by water than San Juan, and possesses the additional advantage of proximity to the coal-fields of Nanaimo and Comox. There appears to be an excellent opening here for an important industry. The best places for work and shipment on Texada Island are Marble Cove, on Malaspina Strait, three miles from the north end of the island, and Marshall Bay, at the northern extreme of the island.

As entire groups of mountains and hills to the east of the Coast ^{Great abundance of lime.} Ranges are frequently composed of limestone, it is naturally impossible to enumerate localities of occurrence of this material generally throughout the Province. It has, however, been considered advisable to mention, on a subsequent page, a few places which from their situation are regarded as of importance, and which have come under my own notice.

Hydraulic limestone, useful for the manufacture of cement, has not ^{Hydraulic cement.} yet been found in the Province, but it must be admitted that in consequence of the very moderate demand which has so far occurred for such material, it has been but little sought after. Nodular calcareous rocks, containing a certain amount of clayey matter, such as occur in the Cretaceous and Tertiary series, sometimes in considerable abundance, appear to be the most probable source of supply of cements, and deserve to be located and experimented with in this connexion.

It is highly probable also that some of the volcanic tuffs of Tertiary ^{Trass.} age, met with particularly in the region of the Interior Plateau, may be found of value for use in the manufacture of cements in a similar way to the *trass* of the vicinity of Andernach and elsewhere on the Rhine, or the Pozzuolana of Naples. These materials are merely ground and mixed, without being calcined, with a certain proportion of quick-lime, and are then found to possess excellent hydraulic properties.

Most of the tuffs actually known to occur in quantity in the Province, are situated at some distance from the line of railway, but it is possible

that some of the tufaceous rocks of the vicinity of Kamloops Lake might be employed in the manufacture of cement. On the coast, I have observed a considerable deposit of material almost identical in appearance with the trass of the Rhine, at Lawn Hill, near the entrance to Skidegate, Queen Charlotte Islands.* Other localities of similar material may also yet be found on the Coast, and should they prove to afford good hydraulic cement, they will possess great value for the construction of wharves, etc., where wooden structures are rapidly destroyed by the teredo.

PRECIOUS STONES.

Absence of gem stones.

Gems of the more valuable species, such as the diamond, sapphire, etc., have not been as yet found in any part of British Columbia, and taking into consideration the great amount of placer gold-mining which has occurred, their apparent absence must be considered as rather remarkable; though this is perhaps due to want of observation on the part of the miners. Garnets are of frequent occurrence, both imbedded in the crystalline rocks and found loose in sluice-boxes in the course of gold-mining, but none have yet been observed sufficiently free from flaws, or of size or colour such as to render them valuable for jewellery.

Agates.

Agates and chalcedony are very often found in association with the volcanic rocks of the Tertiary, and on the shores of the northern part of the Queen Charlotte Islands, as well as along some of the rivers and lakes of the interior, these may be collected in considerable numbers in the form of rolled pebbles. Jasper also occurs in some places in the Tertiary rocks, and the Indians occasionally employed this material and agate in the manufacture of arrow- and spear-heads. It is more common, however, to find arrow-heads in the interior of the Province, composed of black cherty quartzite, which is there abundant in many places. In the Northern Interior the Indians of the Tinné stock often used obsidian or volcanic glass for the same purposes, the most notable locality for this material being the mountain named Béece or Anahim's Peak, in the upper Blackwater country.†

Obsidian.

Opal.

Siliceous deposits of the character of 'wood opal' are found where siliceous springs have issued during the earlier stages of the Tertiary, particularly in the vicinity of Vermilion Forks on the Similkameen and near Dropping-water Creek, about two miles north-west from the head of Stump Lake. At the last-mentioned place, opaline silica and hyalite have been observed, filling cavities in a slightly cavernous trachyte, which occurs in great mass. Some specimens closely ap-

* Report of Progress, Geol. Surv. Can., 1878-79, p. 85 B.

† Report of Progress, Geol. Surv. Can., 1876-77, pp. 78-79.

* Annual
iii, p. 81.
† Canadian
38 B, 147 B.

proach precious opal in character, and the locality appears to be worthy of further examination, as the rock is identical in character with that yielding the precious opal in Hungary and elsewhere.

Specimens of very beautiful blue sodalite, are found in abundance in the vicinity of Ice River, a tributary of the Beaver-foot, in the Rocky Mountains. The mineral closely resembles lapis-lazuli in appearance, and would possess considerable value as an ornamental stone for jewellery, etc. Closer search than we were able to make would probably lead to the discovery of even larger pieces than those found by us, some of which, however, were several inches in diameter. The mineral occurs in connexion with an intrusive mass of nepheline-eyenite.*

Jade or nephrite was highly prized by the Indians of the coast of British Columbia and Alaska for the manufacture of cutting implements of the nature of adzes or 'celts.' It is frequently found in the form of such implements, varying in colour through various shades of green to brown, in the purer varieties quite translucent, but when less pure becoming clouded and opaque. I have elsewhere shown reason for the belief that this mineral occurs in place in the vicinity of the Fraser River, and have since found rolled pieces of it on the Lewes branch of the Yukon.† Some specimens constitute handsome ornamental stones.

Specimens of lignite from some beds of the Tertiary resemble jet in appearance, but are usually too brittle to be employed for purposes of ornament. True jet may, however, be looked for in association with these rocks.

Mineral resin in small drops and patches is of frequent occurrence in some of the Tertiary and Cretaceous coals, and a small specimen of true amber was found in the possession of the Indians in the Queen Charlotte Islands and said to have been derived from the west coast of these islands.

* Annual Report Geol. Surv. Can., 1885, p. 124 R. Trans. Royal Soc. Can. vol. iv, Section III, p. 81.

† Canadian Record of Science, vol. ii, No. 6, 1887. Annual Report Geol. Surv. Can., 1887, pp. 38 R, 147 B.

MISCELLANEOUS MINERALS.

Minerals not discovered.

Ochres.

Tripolite.

Asbestos.

Mica.

Petroleum.

No single specimen of *tin* ore has yet been found in any part of the Province nor have *nickel*, *cobalt*, *manganese* and *chromium* been discovered in anything approaching workable quantity. *Graphite* or *plumbago* is known, but not apparently in useful deposits. *Gypsum* deposits have not been found, and this mineral appears only in the form of selenite crystals in certain shales and clays. Red and yellow *ochres* occur in several places, making, sometimes, a considerable shewing, but no attempt has been made to utilize them so far. *Baryte* or heavy-spar appears only as an accessory mineral, and no deposits of *rock-salt* or of *native sulphur* have been discovered. *Tripolite* or diatomaceous earth appears forming certain layers in the Tertiary clays on the Blackwater, and may probably elsewhere be found in like situations, and in the beds of some of the very numerous lakes and ponds. *Kaolin* or china-clay has not been found. The occurrence of *asbestos* is noted elsewhere, but apparently in small quantity only, though the abundance of serpentine leads to the belief that veins of chrysotile or serpentine-asbestos may be looked for with some probability of success. It is also very probable that valuable deposits of *mica* may be found in some of the granitic districts, and some localities of a promising character have already been observed. *Fire-clays* may be expected to occur in the Cretaceous and Tertiary coal-bearing rocks, but so far as known they have not yet been sought for or tested. *Petroleum* is not known in the Province, and though rumours were current some years since of its occurrence in the northern extension of the Comox coal-field, these could not be substantiated. Tarry, bituminous matter is, however, found oozing out in several places on the Tar Islands of the Queen Charlotte group.

MINERAL AND THERMAL SPRINGS.

Hot Springs.

Salt Springs.

Mineral Springs.

Saline or mineral springs are known in a number of widely scattered localities within the limits of the Province. Several of these are noted as hot springs, and it is probable that all the thermal waters contain notable quantities of saline water. Springs characterized by an abundance of common salt are known at Nanaimo and Admiralty or Salt Spring Island, but the flow of these is not so copious or the strength of the brine sufficient to warrant a belief in their economic importance. Of the other springs, some of which may possess therapeutic value, the only one so far utilized to any considerable extent is that known as "St. Alice's Well," at the lower end of Harrison Lake. A hotel has been built at this place and it is frequented as

a health resort, accommodations for bathing, etc., being provided. There are in the Selkirks and elsewhere a number of springs locally known as "Soda Springs," which are highly charged with carbonic acid gas, and some of which are reported to be excellent as beverages.

In the dry parts of the Interior Plateau region, many more or less saline pools and lakes occur, but the salts in these are usually those resulting merely from the local evaporation of ordinary surface waters. There are also, in the same region, many small saline springs which issue from the superficial deposits or soft Tertiary rocks. These appear generally to contain sulphates of soda, magnesia, etc., and possess no economic or therapeutic importance.

Such notes on individual springs as appear to be of importance are given in connexion with their enumeration on page 162 R.

AL

*It
it has
purpo*

It
cipal
these
Many
others
quantit
facts
and po
Admir
Colum
is also
that an
of vary
work, t
below, h
relative
parenth
The v
up the r

BARS
Maria
wack Riv
(Sever

* Unless o
of the Geolo

ANNOTATED LIST OF LOCALITIES OF MINES AND OF
KNOWN OCCURRENCES OF MINERALS OF ECONOMIC
VALUE IN THE PROVINCE OF BRITISH COLUMBIA.*

GOLD (PLACERS).

Though many of the undermentioned placer-deposits are now abandoned, it has been endeavoured to make the list as complete as possible, for the purpose of indicating the localities of probable occurrence of auriferous veins.

Fraser River.

It is at this date difficult to correctly enumerate and place the principal auriferous 'bars' of the Fraser. The greater part of the work upon these occurred in 1858 and 1859, the first years of the gold excitement. Many bars were then named and worked for a short time only, and of others which were occupied for a longer time and yielded a large quantity of gold, it is not always possible to obtain any statistics or facts of a trustworthy character. The best authority for the names and positions of the more important bars, as far up as Lytton, is the Admiralty map of Vancouver Island and Adjacent Shores of British Columbia, No 1917, corrected to December, 1886. Much information is also contained in Vol. XXXII. of Mr. H. H. Bancroft's works, which that author has been at great pains to collect from innumerable sources of varying authenticity. From statements quoted in Mr. Bancroft's work, the greater part of the details of yield of various bars, given below, has been selected. The names of bars of which the position relatively to the others is not accurately known, are enclosed in parentheses.

The various bars are arranged as far as possible in order, following up the river.

BARs BELOW HOPE.—All these yielded very fine gold only.

Maria Bar.—Twenty-five miles below Hope, near mouth of Chilliwack River. This was the lowest bar on the Fraser which paid for work. (Several bars of which the names are not known.)

* Unless otherwise specified, the references throughout this list of localities are to the Reports of the Geological Survey, of which the dates are given, but not the full titles.

Hudson Bar.—A ditch a mile long here in 1859. Earnings, \$8 to \$10 a day.

Cornish Bar.—First known as *Murderer Bar*, four miles below Hope. In 1860, fifteen men were employed here, making from \$3 to \$4 a day. This and other bars in the vicinity averaged as minimum earnings, \$4 to \$10 in 1858.

BARs BETWEEN HOPE AND YALE.—Some of these bars yielded good results in 1858 and 1859. In 1865 Chinamen were still making from \$2 to \$5 on them.

American Bar.—

(*Union Bar.*)—Two miles above Hope.

St. Clara Bar.—

Posey Bar.—

(*Cameron's Bar.*)—On this bar nineteen men are reported to have made \$75 a day each for three weeks. This was a mid-stream bar.

Emory's Bar.—Average earnings, \$6 to \$8.

Texas Bar.—Yielded as high as \$15 to \$40 a day to the hand.

Hill's Bar.—In 1858, the earnings are stated to have averaged \$16 a day to the hand. Another authority places the earnings at from \$2.50 to \$25. Eight companies were making from \$15 to \$40. Four men on one occasion sluiced out gold to the value of \$1000 in six days. Ten claims, each 26-foot frontage, produced \$30,000 in less than four months. (See p. 26 R)

Yale.—Bars here produced \$15 to \$20 a day per man. Sluicing yielded \$25 to the hand. Mining still in progress in 1888.

BARs BETWEEN YALE AND LYTTON.—The bars between Yale and Boston Bar are reported to have given an average yield of \$12 a day to the hand, early in 1858.

Sailor Bar.—Five and a-half miles above Yale. In 1858 yielded one to four ounces a day to the hand.

Wellington Bar.—

Washington Bar.—

Spuzzum.—(According to Brainerd, there were between Yale and Spuzzum, named, in addition to the above bars—Pike, Madison, Steamboat, Humbug, Surprise and Kelly bars.)

Chapman's Bar.—

Dutchman's Bar.—

Cross Bar.—

Siwash Bar.—

Big Cañon.—

Nicaragua Bar.—In 1859, five men are stated to have taken out gold to the value of \$118 in one day here.

Tehama Bar.—

Island Bar.—

Boston Bar.—Mining begun in 1858. Bench mining in progress in 1888.

Yankee Bar.—

Fargo Bar.—

Mariner's Bar.—

Rancheria Bar.—

New Brunswick Bar.—

Lytton.—Mining begun in 1858. In January, 1859, 100 men at work in this vicinity averaging \$8 a day.

BARs BETWEEN LYTTON AND FOUNTAIN.—In 1859, earnings on these bars from \$8 to \$100. Averaged earnings stated at \$9 to \$10.

Mormon Bar.—In 1858 one rocker produced gold to the value of \$830 in eight days. Another \$800 in twelve days.

Spindulum Flat.—Yielding gold to the value of \$8 to \$10 to the hand in May, 1859.

McGoffery Dry Diggings.—Rich benches. Nuggets valued at 50 cents to \$12 found.

Foster Bar.—A party in July, 1858, obtained here, with rockers, in six hours, three to five ounces to the man. In May, 1865, miners reported to make, with rockers, \$3 to \$8 to the hand. Sluice company producing at the rate of \$8 a day to the hand.

Willow Bank.—Nuggets weighing four to six ounces found here.

Great Falls.—Reported at one time as yielding \$10 to \$30 a day to the hand in coarse gold. Nuggets weighing six ounces found.

Lillooet.—(Known as "Coyoosh" in 1858 and 1859.)

French Bar. (Just above Lillooet). In 1859 yielding \$4 to \$6 with rockers; \$8 to \$12 by sluicing.

Robinson's Bar.—In June, 1858, 100 miners making, at first, \$80 to \$90 a day each. Yield soon fell to \$5 to \$6.

Horse Beef Bar.—In 1859 yielding \$2 to \$6 a day to the hand.

Upper Mormon Bar.—Opposite Fountain. The diggings here and in the vicinity of Fountain were regarded as among the best. In 1858 five rockers were averaging \$47 each a day. There were also good, dry diggings, thirty yards away from the river.

BARs BETWEEN FOUNTAIN AND ALEXANDRIA.—

Day Bar.—Two miles above Fountain. Earnings made of \$8 to \$12.

Haskell Bar.—Eighteen miles above Fountain. Earnings at rate of \$6 to \$12 with rockers; \$16 to \$20 by sluicing.

Big Bar.—Rockers yielded \$5 to \$6.

Island Bar.—Reported as giving good yield.

BARs ABOVE ALEXANDRIA.—In 1859 several of these became rather noted.

British Bar or Cornish Bar.—Thirty miles above Alexandria. In 1860 a ditch five miles long had been made here.

Ferguson Bar or Rich Bar.—Three miles above last. Sixty dollars a day to the man made here for some time.

Long Bar.—Seven miles above Quesnel has been worked almost continuously from early years. Earnings still about \$3 a day.

Spanish Bar.—Thirteen miles above above Quesnel; some work still carried on.

Cottonwood Cañon.—On a high flat here some fairly coarse gold was worked.

Tributaries of Fraser River and Places in its Vicinity not included under Subsequent Headings.

Yale Creek.—Near Yale. A little coarse and rough gold obtained here in late years.

Coquihalla River.—More or less coarse gold has been found along nearly the whole course of this stream, particularly where it cuts an area of the Anderson River slaty rocks, but it has never been extensively worked. In 1864 diggings yielding \$5 a day found on lower part, near Hope. Good prospects found on *Ladner's Creek* and on *Pierre River*, tributaries, and in 1861-62 a good bar worked on the Coquihalla just below the mouth of the last-named creek.

Anderson River.—Some coarse gold found at one time ten miles above mouth, but not enough to pay.

Main River Thompson.—Heavy gold found on this river up to *Nicoamen*, where, it is believed, the first placer gold in paying quantity in British Columbia was found. This region chiefly worked by the Indians of the country, who, I am assured, have obtained many thousand dollars in specially favourable years. River-bars worked here and there, as far up as Kamloops Lake.

Lilloet River.—Flowing into Harrison Lake. Along this stream, in 1859, gold to the value of \$2 to \$4 a day obtained with rocker; \$5 to \$8 by sluicing. Similar earnings in 1867.

Portage between Seton and Anderson Lakes.—In 1880 Indians reported to be making small earnings here.

McGillivray Creek.—Enters Anderson Lake eighteen miles from head on west side. Coarse gold found in 1880. Value \$18-50 per ounce. Gold to the amount of \$1032 obtained in workings near mouth of creek in 1881, and further working abandoned.

Cayoosh Creek.—Diggings discovered in spring of 1886 by Chinese.

Gold worth \$18 to \$18.50 per ounce. In 1886 yielded 725 ounces. Yield in 1888 estimated at about \$52,000. Remunerative work has been carried on here uninterruptedly since the discovery. The gold obtained is on the lower ten miles of the creek, below the outcrops of certain gold-bearing quartz-veins, from which the placer gold is supposed to be derived. (See p. 71 R.) This creek affords a remarkable instance of rich placer deposits which have remained long undiscovered in a country supposed to be well known. Mr. Phair, Mining Recorder, writes:—"It seems almost incredible that this creek, within an hour's walk of the town of Lillooet, should have been passed by for a quarter of a century by hundreds, aye, thousands of the best practical white miners and prospectors of the Pacific Coast, and now at this late date the prize falls into the hands of Chinese." (Report of Minister of Mines of B. C., 1886, p. 207. See also same report for 1887 and 1888, pp. 273 and 312.)

Bridge River.—Discovered in 1858, and soon prospected nearly to its sources and some mining done throughout. Coarse gold for ten miles up from mouth, further up generally scale gold. Some nuggets found on lower part of river of from one to two ounces in weight, and one said to have been worth \$300. This stream at first worked by whites, afterwards chiefly by Chinese and Indians. In 1866 Chinese said to have obtained gold to value of \$66,000 to twelve men, by wing-damming. A good deal of the mining has been done of late years on the South Fork, which is reached by a journey of three or four days from Lillooet, via Seton Lake and across the mountains. Gold worth \$16.50 per ounce, coarse, nuggets worth \$10 to \$22 having been found.

Gun Creek.—A tributary of Bridge River, fifty miles by trail from Lillooet. Placers discovered in 1859 yielding \$6 to \$15 a day.

Cadwallader Creek.—A tributary of Bridge River. Good prospects found here in 1886.

Hat Creek.—Small quantities of gold have been found here.

Scotty's Creek.—A tributary of Bonaparte River. Prospects reported to be good, but boulders in the valley render mining difficult.

Chilcotin River.—Gold in some quantity said to have been found near the mouth of this stream.

Nechacco River.—Colours obtained near Fort Fraser, and also abundant near its junction with the Fraser River.

Chilacco River.—In certain banks near its mouth, eight or nine colours to the pan may be obtained. A small quantity of coarse gold found in a lateral creek by one of the men connected with the Canadian Pacific Railway survey in 1876.

Cariboo District.

WILLIAMS CREEK.—For description see page 34 R. Discovered 1861, and has yielded more gold than any stream in British Columbia. As examples of the yield in early years it may be stated that Steele's claim gave a maximum yield of 409 ounces or \$6524 a day. Over \$100,000 in all taken from this claim of eighty by twenty-five feet. In 1862, Cunningham's claim produced gold to the value of nearly \$2000 a day for the season, while on several days as much as fifty-two pounds weight of gold was taken out. The Adam's claim yielded to each of its three partners \$40,000, clear. These claims were above 'the cañon' in shallow ground. The deep ground below 'the cañon' was first bottomed near the end of 1861 by the Barker Co. (whence Barkerville). The Diller Company was the next successful in this, and it is credibly stated that here, on one occasion, 200 pounds of gold worth \$38,400 was obtained in one day. In 1863, three claims below 'the cañon' yielded \$300,000, and twenty claims were steadily producing from 70 to 400 ounces a day. Four hundred miners were at work on Williams Creek in this year,—'the Golden year.' The aggregate yield of Williams Creek, for the first seven years of working, for which no returns are available, was very large. In 1888 about twelve hydraulic claims were being worked.

The tributaries of Williams Creek, in order down stream, are as follows:—

Mink Gulch.—Joins from the west. Hydraulic work at outlet has paid well.

Walker's Gulch.—Joins from the west at Richfield Court House. Deep work. Good prospects at different times and some quantity of gold taken out at its mouth, but has not held out. Hydraulic work still in progress.

Grub, or Black Jack Gulch.—Joins from the west. A mere ravine of no great length, being all embraced in one claim. Has afforded good pay by hydraulic method, but now worked out.

Stout's Gulch.—Joins from the west, below 'the cañon.' Very rich, but now worked out for drifting. Hydraulic method employed.

Conklin Gulch.—Joins from the east, opposite Barkerville, discovered 1874, and has since proved very rich; the Ericson claim in that year yielding 400 to 500 ounces a day. Ground very deep for so small a valley, being ninety feet in lower part and twenty feet in highest; drifting claim, one mile and a-half up; probably rich for hydraulic working.

McArthur's Creek.—Two miles below Barkerville and one mile above Lane and Kurtz shaft-house; joins from the south-west. Paid well in

drifting deep ground, but now worked out for this method. No hydraulic work in progress.

Creeks entering Willow River.—

Lowhee Creek.—Discovered, 1861. Runs northward, nearly parallel to Williams Creek, and empties into Jack-of-Clubs Lake, which also receives Jack-of-Clubs Creek, and is the source of the Willow River. Good pay found in both shallow and deep diggings, and some good ground still being worked. Gold, especially near source of creek, very coarse and rough, often including fragments of quartz. Found difficult to obtain water for hydraulic work here, but otherwise promising. The Jordon and Abbott claim in 1861, yielded from eighty to a hundred ounces daily, and in 1884, the Sage-Miller claim yielded for a time from 300 to 400 ounces a day.

Jack-of-Clubs Creek.—All deep work on this creek, gravel being 150 feet in depth near the mouth, where a few claims paid well. This creek is a favourite among those which are considered yet unproven, the impression being that an old channel exists which has not been found.

Mosquito Creek and Red Gulch.—Entering Willow River from the south below the last have been very rich. The ground was fifty feet deep at mouth; now worked out for drifting. Hydraulic work has paid well.

Whip-saw Creek.—Three miles below Mosquito Creek, on the same side. In former years, from \$10 to \$12 per day per hand taken out, and more or less work carried on for many years by ground-slucing and drifting. No work now in progress but considered promising.

Several creeks below Whip-saw Creek on the south-west side of Willow River, have afforded no pay; fair prospects have been obtained in some creeks on the north-east side, but no rich paying ground found.

Hardscable Creek.—Joins Willow River from the north. Drifting and hydraulic work has been carried on, but without very important result.

Slough Creek.—Joins Willow Creek from south and east, seven miles below Jack-of-Clubs Lake. Chiefly bench and shallow diggings. Main valley never bottomed, but considered promising.

Burns' Creek.—Tributary of the last, from the north. Has yielded a good deal of gold from both deep and shallow diggings.

Devil's Cañon.—Joins Slough Creek from the south, half a mile below last. Bench mining still going on.

Coulter Creek.—Tributary of Slough Creek. Gold worked some years ago.

Nelson Creek.—Joins Slough Creek from the south-west four miles below Jack-of-Clubs Lake. Hydraulic work.

New Creek.—Tributary of Slough Creek. A little work done here a few years ago.

Dragon Creek.—Tributary of Willow River. Two miles of the lower part of this creek worked four years ago.

Rouchon Creek (sometimes called *Russian Creek*).—Joins Willow River from south, thirteen miles below Jack-of-Clubs Lake. Sluicing yielded \$4 to \$5 a day to the man. Mining still going on.

Barry or Berry Creek.—Joins Willow River from south-west fifteen miles below lake. Shallow diggings.

Archer Creek.—A little work on shallow diggings some years ago.

Deadwood Creek.—Joins Willow River from the west five miles below last. Shallow diggings.

Sugar Creek.—A branch of Valley Creek, which joins Willow River from the east a short distance above Deadwood Creek. Some good prospects, but never much pay. Some hydraulic work has been carried on.

Cañon Creek.—A stream running into Willow River far down its course, and reached by a trail twenty miles long from Beaver Pass House. Prospecting has been carried on here, but no rich placers found.

Creeks lower down Willow River are known to hold some gold, but have not yielded it in paying quantity.

LIGHTNING CREEK.—Discovered in 1861, and in that year \$200,000 worth of gold taken from Campbell's Discovery claim and the adjacent Whitehall claim. Attempts were made almost from the first to reach the deep channel of this creek, but after much work, these were abandoned in 1864. Sinking was, however, resumed in 1870, and having proved successful, led to the subsequent great developments. The rich character of some of the ground on this creek may be illustrated by stating that at one time the Butcher claim yielded 350 ounces a day, the Aurora, 300 to 600 ounces, and the Caledonia, 300 ounces. For description see page 34 R.

The tributaries of Lightning Creek, in order, down stream, are as follows:—

Amador Creek.—No good pay yet found.

Van Winkle Creek.—Discovered, 1861. About 2000 feet of the lower end of this valley paid well. In 1861 a company of four took out an average amount each of \$600 worth of gold during the season.

Dead Man's Creek.—

Perkins' Creek.—Some gold obtained here of late years.

Chisholm Creek.—Good pay in shallow workings. Deep ground unproved, though great efforts have been made to test it.

Last Chance Creek.—Estimated that \$250,000 worth of gold taken out

of this creek in a length of half a mile. Rich ground now probably worked out.

Davis Creek.—Good pay in shallow ground.

Anderson Creek.—Good pay in shallow ground.

Jaw-bone Creek.—No good pay found.

Peter's Creek.—Joins Lightning Creek from the south-east, a mile below Beaver Pass. Reported to have afforded a considerable quantity of gold. Not recently worked.

Basford Creek.—Tributary of the last. Work has been carried on here.

Campbell's Creek.—Also a tributary of Peter's Creek. Gold found and worked, but no particulars.

French Creek and Canadian Creek.—Joining Pleasant Valley from the south, have both yielded some gold and were found locally rich, though paying ground run was through where the working was carried on. Probably not exhausted.

Grouse Creek.—Six miles east of Barkerville, heading with Antler Creek. Discovered 1860. Mined to some extent in 1861 and 1862, but with renewed vigour in 1864. The deep ground was very rich, and extended for about a mile near the upper part of the creek, giving out farther down. Deep ground worked out. Appearances favorable for hydraulic work.

Antler Creek.—Discovered 1859, but no work done till 1860. Heads in Bald Mountain, opposite Williams Creek, and was one of the first creeks worked in this part of the country. Shallow ground for two miles, paid well, and has been worked out. The deep ground has not yet been much tested, owing to the absence of clay, and consequent large quantity of water met with in sinking. All the gulches joining Antler Creek from the source down, have paid (*Wolf, California, Stephens', and Begg's Gulches.*) The creek has never been bottomed where these side valleys fall in. Chinese have been at work, and get pay on benches 100 feet above the stream, a long way down. Antler Creek yielded gold to the amount of \$10,000 a day for some time in 1861. It is stated that one company of three men obtained in three weeks washing, \$83,300, and that in some spots the ground yielded \$1000 to the square foot.

Nugget Gulch.—Tributary of Antler Creek. Good pay found at mouth. Upper part not tested.

Victoria Creek.—Tributary of Antler Creek. Has been mined near the mouth.

Branch of Eight-mile Creek.—(Five miles north of Barkerville.) A little mining work carried on here in early years.

Pleasant Valley.—A transverse depression, four miles in length, uniting the valleys of Williams and Antler creeks, and joining the former about three miles below Barkerville. Has never been bottomed or much prospected, but might be embraced in a scheme for draining the valley of Williams Creek. (See p. 37 R.)

Bear River, and country about Bear Lake.—Gold has not been found here in paying quantity.

Swamp River.—Has attracted some attention, but no good pay has yet been found.

Cunningham Cr. ek.—Discovered 1860, but not much worked till 1864. In early days, a crevice containing 600 ounces of gold was found on this creek, about twelve miles from its mouth. Several hydraulic claims have been worked here. Since 1864, attempts to reach the deep ground have been made, but have not succeeded. It has always been supposed that the deep ground in this creek would turn out rich, and if once proven to be so, a large amount of work would immediately be undertaken.

Harvey Creek.—The first gold in paying quantity in the Cariboo district proper was found here in 1860, but comparatively little work was done till 1864. One claim—the Minnehaha—has been exceedingly rich. Another at the junction of Swamp River, has paid well. The Cummings Company bottomed it at one place, and drifted up in a small cañon (unsuccessfully,) but found pay on entering wide ground. The upper part of the creek is deep, and has not yet been thoroughly proven.

Creeks flowing into Cariboo Lake.—In *Nigger, Pine, and Goose Creeks*, small quantities of gold have been found. On the last-named, much money was spent in putting in a flume, but with small result.

Keithly Creek.—Discovered in autumn of 1860. The main creek has only moderately deep ground, (twenty to twenty-three feet,) of which some is yet unworked; it being expensive to open on account of the great quantity of water. Benches 100 feet above the stream have paid for open work, and some of them for drifting also, while a number of Chinese, who worked about the mouth, also got good pay. A little hydraulic work has been attempted here with fair results.

Main Snow-shoe Creek.—Tributary of Keithly Creek. Has been mined about one mile up, affording good pay. Ground deep. A tunnel about three-quarters of a mile long is being driven to work the bed-rock.

Little Snow-shoe Creek.—Tributary of Main Snow-shoe Creek. This is considered to be one of the most promising creeks of which the deep ground (though not extensive) has not been worked. Good pay

ob
can
one
the
drif
L
imp
S
sou
carr
ed f
B
mini
Not
Ka
abov
Cee
prett
\$20,0
next,
Chine
Coq
over t
1886.
Haz
ed her
Moo
Prospe
Ques
river,
and fif
region
the Fo
district
Branch
Lake,
Swift
stream
have be
Foun
Mount

obtained from shallow workings. Hydraulic work has been steadily carried on for some years and pays well.

French Snow-shoe Creek.—Tributary of Snow-shoe Creek. Worked at one place, near the cañon, where the ground was shallow. Elsewhere, the deep ground has not been tested.

Four-mile Creek.—Tributary of Keithly Creek. Hydraulic mines and drifting near the mouth. Good pay.

Duck Creek.—Chinese have worked here. No recent mining of importance.

Spanish Creek.—Falls into North Fork of Quesnel River from the south (draining Spanish Lake) six miles below Cariboo Lake. Mining carried on at different times, but not recently. Prospects still considered favourable.

Black Bear Creek.—North Fork of Quesnel. Much prospecting and mining have been done here and coarse gold found, but no rich pay. Not yet considered fairly tested, the ground being hard to work.

Kangaroo Creek.—Joins North Fork of Quesnel about two miles above its junction with the South Fork. Paid well at one time.

Cedar Creek.—Discovered in 1862, but scarcely worked till 1866. One pretty rich claim was worked here,—the Aurora—which yielded \$20,000 in 1866. There were some other good claims in this year and the next. Pay-dirt six to eight feet thick. The creek is now worked by Chinese, who use the hydraulic method on a pretty large scale.

Coquette Creek.—Near the last. Discovered 1866, but soon given over to Chinese and worked by them for some years. Not worked in 1886.

Hazeltine's Creek.—Some encouraging 'prospects' have been obtained here.

Moorhead Creek.—Some work done here, but without good result. Prospecting still going on. (1886)

Quesnel River.—Discovered 1859. Most of the work done on bars of river, though many workings on benches one hundred to one hundred and fifty feet above the water pay well. The gold is all fine. This region is now altogether in the hands of Chinese who resort chiefly to the Forks and South Branch. Several hundred Chinese work in this district during the summer, and winter at the Forks. The North Branch is said to have afforded profitable diggings as far up as Cariboo Lake.

Swift River.—Rather inaccessible, and hard to work, being a rapid stream with many heavy boulders. Considerable quantities of gold have been taken from it from time to time, and Chinese still at work.

Fountain Creek.—A tributary of Swift River, nine miles west of Mount Agnes. Chinese mining.

Cañon Creek.—A second stream of the same name, joins the Fraser from the east above Quesnel. Diggings first reported in 1865. A considerable quantity of gold obtained here formerly, some of it very coarse and mixed with quartz.

Hixon Creek.—Discovered, 1866. A branch of the last. A nugget worth \$700 was found here, and considerable placer-mining carried on for a length of two miles and a-half on the creek.

Terry Creek.—A tributary of Cañon Creek. Discovered, 1867. Shallow diggings yielded \$6 to \$8 a day.

Goat River.—Discovered, 1836. East of the lower part of Willow River and flowing into Upper Fraser River. A trail cut out to the creek in 1887, and some mining carried on.

Smoky River.—Discovered 1887. A tributary of Upper Fraser River from the north, some distance below last. Prospects of \$3 to \$4 obtained with rocker, and considered encouraging.

Horse-fly River.—South of Quesnel Lake. Discovered and prospected in 1859 and 1860, in which years some paying work done on Horse-fly Creek, the branch connecting Horse-fly Lake with the main river. A party of five here took out at one time 101 ounces of gold in a week. Renewed excitement in 1867. More or less mining has since been carried out on this river and tributaries, particularly by Chinese. But no really important developments have occurred.

McLennan Creek.—Thirteen miles from Tête Jaune Cache, running into Cranberry Lake. Gold found in 1876, reported at \$4 to \$5 a day, but owing to heavy boulders in the stream and expense of supplies, has not been worked.

Similkameen, Rock Creek and Okanagan.

Main River Similkameen.—(Below Vermilion Forks.) Gold found in sharp unwashed particles at mouth in 1853, by Captain McLennan's party. In the cañon, near the 49th parallel, a considerable quantity of gold obtained in 1859-60; the largest piece worth \$22.50. Few Whites remained on the river after the first few years, but much work was done by Chinese. In 1866, a little excitement occurred, and forty or fifty Chinese went in to work. After this the river was almost abandoned for some years, but about 1882, mining revived, and a few Chinese have been at work, scattered along the river from Vermilion Forks to the 49th parallel, ever since. Work confined to river-bars and low flats bordering the river. Gold all scaly or fine.

Creek, six miles above Boundary.—(South side of river.) Chinese have lately been working here.

* See foot
† Localities
them has yet

Ashtinoulou River.—Joining Similkameen from the south. Scale gold found but Indians object to its being worked.

Siwash Creek, or Five-mile Creek.—Below Vermilion Forks on north side. Prospects obtained, but nothing to justify extensive work.

Wolf Creek.—Joins Similkameen about nine miles below Vermilion Forks on south side. This heads with the source of a small stream which joins the South Fork of Similkameen, about nine miles above Vermilion Forks, a low valley running through. Miners think that this valley represents an old channel of the river, and attempts have been made to bottom it, but without success.

South Fork Similkameen.—Gold discovered by government prospecting party under Mr. Allison in 1860, and Whites and Chinese have been working off and on ever since. \$10 to \$20 a day to the hand obtained occasionally in early years on bars. Gold fairly coarse for thirty miles up from mouth and also found above this point, but not worked. Chinese have worked also in a little creek about sixteen miles up on west side. (See Report 1877-88, p. 156, B.)*

Whip-saw Creek.—Tributary to South Similkameen, from the west. Worked in a desultory manner since discovery of gold on the river, the workings extending three or four miles up. Gold rather coarse. The bed-rock here and in the neighboring part of the Similkameen consists of Tertiary strata. It seems not improbable that richer deposits may be found beneath these in the pre-Miocene valley which they fill.

Skagit River.—Prospects found in several places in early years, but no mining north of 49th parallel. On *Ruby Creek*, a tributary further south, gold discovered and working began in 1879.

Nine-mile Creek.—A tributary of the last, heading near Granite Creek. Worked last summer for a mile or two from mouth. Gold rather coarse. More or less platinum found in this and on the streams previously mentioned.

Tulameen or North Fork of Similkameen.†—Some work done on this river as early as 1862, and though nearly all the white miners were drawn away to Cariboo about that time, it is nearly certain that Chinese have been working off and on ever since. Working resumed by whites as well as Chinese about nine years ago. River proved rich from mouth up for about two miles, and paying work still in progress at various places all the way up to two miles above Eagle Creek—twenty-three miles from mouth. Gold often coarse, and on lower two miles does not appear so much washed as further up. On this part of river, three years ago, one company aver-

* See foot-note p. 115 B.

† Localities in this vicinity are referred to in greater detail, as no published description of them has yet appeared in the Reports of the Survey.

aged earnings of \$8 to the hand. Four years ago, several miners made as high as \$20. All the work on the lower part of the river has been river-bar mining. Platinum is found everywhere along the river with the gold, and native copper in scales and nuggets weighing as much as an ounce is occasionally found. Above Slate Creek, low benches and flats are mined by sluicing as well as the bed of the river by wing-damming, and Indians work here and there with rockers. It is thought that the extensive benches in the angle between the Tulameen and South Similkameen would pay for hydraulic work, but it is difficult to obtain water for this. Pellets of silver-glance, strung through with gold, have been found in sluice-boxes above Otter River.

Granite Creek.—Joins Tulameen from the south, nine miles above its mouth. Gold discovered in 1885 and caused considerable excitement, resulting in a great rush to the creek in the same year. Benches or terraces 200 to 300 feet high occur at mouth of creek, but these have been cut through as the drainage-level lowered, leaving a flat delta or fan, on which the town is built. Just above this the valley becomes narrow or v-shaped and runs back between bold mountains which rise about 2000 feet above it. At the bottom of the valley is a cañon 200 to 300 feet deep which continues for nearly four miles. Above this the upper part of the creek and its branches are wider and with lower grades and have not been bottomed. Nearly all the gold has been obtained below the First Fork or in the first three miles and a-half in length of the creek, in which the bed-rock was found at a depth of a few feet. There is very little bench- or side-ground along this part of the creek, though an old higher channel, with good pay, is occasionally found running across points (as at the Gladstone claim). One or more runs of heavy gold are found in the 'fan' at the mouth of the creek, which has yielded in places two ounces to a set of timbers, 10 x 5 feet. The bed-rock has, however, not been reached below the mouth of the cañon. The greater part of the rich ground on this creek has been worked out, being quite limited. The gold is coarse and rough, and the platinum, which sometimes amounts to half by weight, has the same character, denoting a very local origin. About half a mile above the First Fork, a patch of silicified Tertiary argillite occurs in the bottom of the valley, shewing that the gorge is of pre-Miocene age, and the greater part of the erosion to which the concentration of the gold is due probably also dates from this early period. Forty Whites, and about the same number of Chinese on the creek in 1888. Several nuggets worth from \$90 to \$100 have been found. The yield of the creek is estimated at \$90,000 in 1885; \$170,000 in 1886, and \$90,000 in 1887.

Collin's Gulch.—South side of Tulameen opposite Otter River. Heavy gold found and a little work done. A small ravine only.

Cedar Creek.—South side of Tulameen above the last. Gold rather heavy. A little work done. One claim gave \$10 a day to the hand the first season. Coarse platinum found with the gold.

Slate Creek.—South side of Tulameen four miles above Otter River. Gold discovered 1885. Work in progress since 1886. Best result in 1887, \$7 a day to the hand. Small hydraulic claim working at mouth. Gold coarse and associated with coarse platinum.

Bear Creek.—North side of Tulameen one mile above last. Creek runs on bed-rock at mouth, and here a nugget worth \$320 was found. Above the mouth ground deep and has not been bottomed. Much gold on the Tulameen below mouth of this creek, which appears to deserve further work.

Hine's Creek.—A small gulch above the last, on the opposite side of the river. 'Prospect' of coarse gold.

Eagle Creek.—Joins Tulameen from north-west two miles and a-half above Bear Creek. Coarse gold found but not much mining done.

Champion Creek.—Joins Tulameen from south-east, about six miles above last. A large stream affording good prospects, but the ground has never been bottomed.

Boulder Creek.—Joins Otter River from the west, near its mouth. Apart from Granite Creek and the main river, most of the work in 1888 done here. Worked for about a mile and a-half up from mouth.

Rock Creek.—East of Osoyoos Lake; a tributary of Kettle River. Gold discovered in 1859 or 1860. The narrow valley of the creek paid well for about a mile up, yielding generally one to two ounces a day to the man. Some of the benches also paid, in one case, yielding half an ounce a day to the hand for a season's work. In 1861, 300 miners were at work here, but it was nearly abandoned in the following year. Working was renewed to a considerable extent in 1866. In 1868, \$8 to \$10 a day to the hand was obtained by ground-sluicing, and a bed-rock flume was constructed. In 1870 the Flume Company took out \$6000 at their first 'clean up.' At the mouth of the creek, a large quantity of gravel had been deposited where the valley widened, and this was all thoroughly worked over, chiefly by Chinese, who have never quite abandoned these diggings. Desultory work among large boulders, which obstruct the channel, was carried on for many miles up the creek in early years, and lately a good deal of successful placer work has been done about ten miles up the creek. It is near the last-mentioned place that the 'quartz' discoveries elsewhere mentioned (p. 68 R) have taken place.

Boundary Creek.—Joins Kettle River from the north-east. Developed

a little later than the last. Some very coarse gold found here, and a good deal of desultory work done, but pay 'spotted.' Like the last, the valley of this stream is narrow and cañon-like, and most of the mining was done near its mouth, and in places further up, where it widened locally.

Kettle or Nehoialpithwa River.—'Prospects' found and small quantities of gold obtained on this river and several of its tributaries, nearly to the head, but no mining of importance ever carried on. Country very thickly wooded and difficult of access.

Okanagan River and Lake.—Scattered diggings found in 1859-60, but most of these soon abandoned; some because of want of water for working, and others probably left at the time of Cariboo excitement. In 1851, Mr. Cox, Gold Commissioner at Rock Creek, writes:—"We prospected nine streams, all tributaries of the lake, and found gold in each, averaging from thirty to ninety cents a pan."

Mission Creek.—Joining Okanagan Lake from the east, is the only one of the streams above mentioned on which mining of importance has occurred. Mining began on this creek about 1875 or 1876 and has continued more or less actively since, attempts being made to use hydraulic machinery. Paid at one time at rate of two to three ounces to two to three dollars a day to the hand. Gold worth \$18.50 an ounce. The greater part of the gold was obtained at a place about seven miles up the creek, where it issues from a narrow, rocky gorge into a wider valley. The stream-bed gave the best returns, but benches and flats have also been worked. The modern gravels here rest on soft Tertiary shales, and are more or less cemented by calcareous matter in their auriferous layers. It is quite possible that a second channel remains to be found beneath the edge of the Tertiary. Gold coarse. (See Report 1877-78, p. 157 B, also p. 48 R of this report.)

Cherry Creek.—Tributary of Shuswap River, thirty-five miles east of head of Okanagan Lake. Gold mining has been prosecuted here with varying success for thirteen years or more. The richest ground has been found in the lower three miles and a half of the south branch. Bed of creek here originally worked by wing-damming, and considerable work on benches and flats. In 1877 the best claim was paying about \$10 a day to the hand. Nuggets worth \$40, \$90 and \$130 have been found, and the gold generally is coarse. Assay value \$15.60 to \$16 per ounce, the alloy of silver being rather high. (See Report, 1877-78, p. 158 B. Also p. 68 R of this Report.)

East and West Kootanie. (South of line of C. P. Railway.)

Wild Horse Creek.—Discovered to be auriferous in 1863, and became an important camp, with four hundred miners, early in the following

DAW
ye
han
to f
ham
por
The
in t
rapi
on t
the
year
obta
Yiel
were
(Rep
Bu
gold
cañon
Fin
Diggi
time.
In 18
upper
five m
second
Dut
worked
Toby
1864, a
in 1885
in prog
Caño
covered
to be m
sumed
Quar
P. Ry.
ity. A
in 1888,
Porcu
from Do
\$16 to t

year. Ordinary claims were then paying from \$20 to \$30 a day to the hand. In 1865, estimated that one thousand men were here and forty to fifty claims were working, producing one to three ounces to the hand. Nuggets valued at \$100 have frequently been obtained. The portion of the valley rich in gold is about two miles only in length. The bed-rock was found at no great depth below the present stream-bed in this part of the valley. The lower part of the old channel deepens rapidly and has never been reached. Profitable work has never ceased on this creek since its discovery, though the yield has fallen off after the first years. The value of gold obtained from 1878 to 1887 (ten years) is returned at \$231,380. The greater part of the gold is now obtained by the hydraulic method, five companies being at work in 1888. Yield in 1888, \$24,400, though only a portion of the flumes and sluices were 'cleaned up' before winter. The gold is worth \$18.25 an ounce. (Report 1885, p. 152 B.)

Bull River.—Ten miles southward from Wild Horse Creek, coarse gold has been obtained from time to time in paying quantity near the cañon, but can be worked only at low water.

Findlay Creek.—Thirty-two miles northward from Wild Horse Creek, Diggings discovered in 1865, and more or less mining from time to time. Much trouble from freshets, but prospects considered excellent. In 1886, an English company obtained a grant of about four miles on upper part of the creek where gravel benches prospect well. A ditch five miles long has been constructed, and hydraulic work begun. A second hydraulic company is at work further down on the creek.

Dutch Creek.—Lower end Upper Columbia Lake. Gold has been worked here to a limited extent from time to time.

Toby Creek.—Lower end of Lower Columbia Lake. Diggings found in 1864, and considerable excitement for a time. Renewed interest in 1885, when twenty men went to work on it, but in 1887, no work was in progress.

Cañon Creek.—Five miles south of Golden Station, C. P. Ry. Discovered 1883. Some coarse gold obtained and a few miners reported to be making \$2 a day in 1884. In 1887, no work. Work to be resumed by a company in 1889.

Quartz Creek.—Falling into Columbia River near Beaver Station, C. P. Ry. Gold discovered in 1884, but not at that time in paying quantity. About eighteen miles from Donald. Nineteen locations taken up in 1888, and active work expected. Ground ten to fifteen feet deep.

Porcupine Creek.—A tributary of Quartz Creek. Eighteen miles from Donald Station, C. P. Ry. Five claims worked in 1888, averaged \$16 to the hand a day.

Perry Creek.—A branch of St. Mary River. Coarse gold found in 1867. In the following years claims reported as generally yielding an ounce a day. In 1869, a large number of miners on the creek. Mining carried on since with little interruption, but generally in a desultory manner. Below the falls a "clay bed-rock" was met with, beneath which was a deeper layer of auriferous gravel. This was reached in some places, but the water generally prevented work. Reported that in 1869, gold to the value of \$1500, was obtained in the deep gravel, from eight square feet of ground. The Perry Creek Gold Mining Co., are now at work here on a somewhat extensive scale, and with fair prospect of success. They have a tunnel over 550 feet long at the present time, running for bed of old creek, three miles above the site of the old mining camp. Their shaft, five miles above the same place is temporarily abandoned, owing to water.

Moyie River.—Placer camp located here in 1869. Mining has been carried on ever since with varied results, but never very extensively. Diggings said to be 'spotted.' Earnings of \$3 to \$4 a day to the man have been obtained. Gold worth over \$18 per ounce, and often coarse. Only three Chinese at work in 1888.

Pend d'Oreille River.—Somewhat extensive work in early years yielding from \$3 to \$4 a day.

Weaver Creek.—Flows into Moyie Lake. Very coarse gold found. High assay value. More or less work has been irregularly carried on for many years. In 1888 about \$5000 in coarse gold obtained.

Palmer's Bar Creek.—Empties into Moyie River about four miles above lake. More or less work for a number of years, but no striking developments. Coarse gold. Yielded \$1023 to a company of four Chinamen in 1888.

Boulder Creek.—Flows into Kootanie River about twenty-five miles from Bonner's Ferry. Coarse gold found.

Nigger Creek.—Situated between Weaver Creek and Palmer's Bar. Some work for a number of years. Coarse gold but 'spotted.' Abandoned in 1887.

Kootanie River.—Chinese have obtained fair wages near Tobacco Plains and below, but no regular work.

Gold Creek.—Flows into Kootanie River near Tobacco Plains, close to the Boundary line. Fine gold, not found in paying quantity.

Deer Creek.—Flows into Upper Arrow Lake about the middle, from the west. Prospect of heavy gold at time of Big Bend excitement.

Fish River.—Enters north-east arm of Upper Arrow Lake. Known to be auriferous.

Mosquito Creek.—A western tributary of the Columbia, between Upper and Lower Arrow Lakes. Gold found.

Lardo River.—Entering Kootanie Lake at north end, from the west. Gold found.

Slocan River.—Joining Kootanie River from the north below the lake. Gold found.

Howser Creek.—On this and another stream tributary to Duncan River, which flows into the north end of upper Kootanie Lake, coarse gold has been found. No work of importance.

Salmon Creek.—Flows into Pend d'Oreille River, near its mouth. Work here in 1865 and later, and some good results.

Forty-nine Creek.—Flows into Kootanie River below the lake. Work in 1867 and later. In 1867, reported to yield coarse gold to the value of \$6 to \$18 to the hand. This creek and the last, head toward the Toad Mountain area, where quartz developments, elsewhere described, are in progress. Bed-rock not worked.

Cottonwood Creek.—Joins lower end of west arm of Kootanie Lake. Prospects obtained.

Columbia River.—Wherever suitably circumstanced bars occur along this stream, to the north of the 49th parallel, fine gold is found in greater or less quantity. In 1865, several hundred Chinese were at work within a short distance above Fort Shepherd. On bars five miles above Revelstoke, \$1.50 to \$2.50 a day is obtained at low water.

Big Bend Country.

French Creek.—Tributary of Gold Creek nine miles from its mouth. Fifty miles north of Revelstoke, C. P. Ry. Discovered 1865, and in that year yielded at least \$32,000. In 1866 the Big Bend excitement occurred, and this creek is reported to have produced gold to the value of \$100,000. In this year or the next, four, six and even twelve ounces to the hand a day was obtained on some claims, and one nugget worth \$253 was found. French Creek was the richest in the Big Bend region. Lower part of valley all deep ground which has never been bottomed. The creek was entirely abandoned for a number of years, but work was resumed in 1886, attention being chiefly turned to the unexplored deepground, with promising indications. Creek and hill claims, however, still being worked with some success. Mr. G. M. Sproat estimates that this creek and its tributaries affords about twenty-five miles of mining ground. A company at work in 1888 did very well toward the autumn, when they lost the pay streak. (See Reports of Minister of Mines of B.C., 1886, 1887, 1888.)

McCulloch Creek.—A tributary of Gold Creek, four miles lower down than the last. Reported as a short creek, about four miles only in length. History like that of French Creek, and as in the case of

that creek said to have yielded about \$100,000 in 1866. Yielded \$100 a day to the hand in some claims in early years, and nuggets and rough gold with quartz attached found on it. Surface diggings worked out and deep ground found very difficult and full of boulders. Work resumed in 1886, and has been continued to date, companies driving tunnels for deep ground with good prospects. A bed-rock flume company obtained a considerable amount of coarse gold in 1888 on the lower part of the creek. (See Reports of Minister of Mines of B.C., 1886, 1887, 1888.)

Downie Creek.—Flows into Columbia River from the east, thirty-five mile above Revelstoke. A large stream, but appears never to have been systematically prospected. Moderately good pay said to have been found at one place eight or ten miles up it in 1867.

Carne's Creek.—East side of Columbia River, twenty miles north of Revelstoke. Discovered 1865. This creek is six miles long to its forks, and each of the branches is supposed to be about the same length. A cañon quarter of a mile from the mouth; wide gravel banks below cañon; valley narrow above it. Mining on bars in early years, the old valley not having been followed owing to water. Coarse gold. For a time, below the cañon, earnings were \$15 a day. Work renewed in 1886 in several places, one company making \$8 to \$10 a day to the man on the average. Bed-rock conjectured to be from forty to seventy feet deep. Work difficult on account of floods. Creek considered promising mining ground, and the benches suited for hydraulic work. (See Reports of Minister of Mines, B.C., 1886 and 1887.)

Smith's Creek.—A large stream joining the Columbia from the west opposite Gold Creek. In 1886 fifteen white miners here making \$2 to \$11.20 a day to the man. The creek is twenty-five miles long and is considered promising. Fair 'wages' made here in 1888. A company putting in a long flume. (See Report of Minister of Mines of B.C. 1887.)

Fernie Creek.—Joins Columbia River eight miles above last. Coarse gold. In early years, \$8 a day to the hand made by four men for a whole season. Mr. Sproat remarks that there are, including this and Smith's Creek, nine large creeks on the west side, and three on the east side of the Columbia, between Gold Creek and the mouth of Canoe River, in which pay gold was found in 1887, all worthy of being carefully prospected.

Frenchman's Creek.—The second stream up Cance River on the east. Gave good pay found for a season, some years ago.

North Fork Illecillewaet River.—Gold has been found here, but little worked.

Nic
or as
north-
Nic
work
Guid
from t
Dea
loops I
cañon
probab
Tran
discove
ction
thirty C
number
The gra
flats adj
in all, u
ciated w
canic ma
1877-78,
Cherry
a little w
North
loops, at
Jamies
Some min
Louis C
Some min
\$10 a day
ally work
mouth of
sidered pr
Barrière
Mining sa
1861.
Adams
years, and
the lake, b
Shuswap
whole coun

Kamloops Region and North and South Thompson Rivers.

Nicola River.—Scale gold found for about twenty miles up the Nicola, or as far as the mouth of Spioos Creek, also on Spioos Creek and its north-west branch, Prospect Creek. Only a little desultory mining done.

Nicola River, above Douglas Lake.—Some gold found in 1887, and worked to a limited extent by Whites and Indians.

Guichon Creek.—Prospect of fine gold reported in stream flowing in from the east below Mamit Lake.

Deadman River.—Joins Thompson River from the north below Kamloops Lake. A Chinese company worked on the east branch, in the cañon a short distance above the forks, for one season. Ground probably poor.

Tranquille River.—Enters Kamloops Lake from the north. Gold discovered 1858, and appears to have been worked with little interruption ever since, chiefly by Chinese. For many years twenty to thirty Chinese have been continuously employed here, but latterly the number has decreased and the earnings are now supposed to be small. The gravels worked are those of the banks and bed of the stream, and flats adjacent to it. Gold has been found for a distance of eight miles, in all, up the stream. It is mostly sealy and some platinum is associated with it. The rocks cut through by the stream are Tertiary volcanic materials, and the origin of the gold is obscure. (See Report of 1877-78, p. 155 B.)

Cherry Bluff Creek, Kamloops Lake.—Gold has been found here, and a little work was attempted at one time.

North Thompson River.—A few of the river-bars, not far above Kamloops, at one time paid to work.

Jumieson Creek.—Thirteen miles up North Thompson, west side. Some mining has been carried on here.

Louis Creek.—Twenty-nine miles up North Thompson, east side. Some mining said to have been done here as early as 1861, when \$8 to \$10 a day was reported to be made. Chinese and others have occasionally worked here since, chiefly in and just below the cañon, near the mouth of the creek. Higher tributaries to the south-eastward considered promising.

Barrière River.—Thirty-two miles up North Thompson, east side. Mining said to have been carried on here with good results in or about 1861.

Adam River and Lake.—Some mining was carried on here in early years, and gold reported lately on some small streams flowing into the lake, but nothing of importance developed.

Shuswap River.—More or less fine gold said to occur on bars along whole course. Some work done in early years.

Scotch Creek.—Flows into lower part of Great Shuswap Lake. Some mining done here at different times previous to 1877 but abandoned for a number of years. Mining renewed in 1885 and in 1886, gold to the value of \$22,000 produced. In the following year, the yield fell to \$4000, and the creek is now again abandoned except by a few Chinese. Mining was carried on as far up as the forks, eight miles from mouth of creek. Gold coarse, sells at \$17 an ounce.

Omenica Region and Peace River.

Vital Creek.—Tributary of Omenica River. Gold found 1869. First work done one mile and a-quarter from mouth in ground from two to four feet deep. One-tenth of metal found 'silver' (arquerite) of which some nuggets to three ounces in weight. Some work still in progress in 1886.

Silver Creek.—Tributary of the last. 'Two-and-a-half-dollar' diggings found in 1870.

Omenica River.—More or less gold on the bars.

Germanen Creek.—Discovered in 1870 and soon became the principal mining locality. Flows into Omenica River on south side, and heads in lake near head-waters of Vital Creek. In 1870 good shallow diggings for three miles, yielding half an ounce to three ounces of gold a day to the man. Total yield in this year \$70,000. In 1871 much work going on. Three men, near the mouth, took out ten ounces a day to the man, but there were many blanks. Some hydraulic work on benches has been successfully carried on. 'Silver' (arquerite) also found in this creek. Some work still in progress in 1886.

Mansen Creek.—Flows into Mansen Lake. Gold discovered 1871. Yielded \$20 a day to the man in some places, and nuggets worth \$80 and \$100 were found. Two companies sank shafts to deep channel, with good results in this year. Only two companies at work in 1875 and making little. Some work still going on in 1886.

Slate Creek.—A tributary of the last. Found rich in 1872, but fell off greatly in the following year. Miners stated to be making expenses in 1875.

Lost Creek.—A tributary of Mansen Creek. The "Irwin Company" of five men took out 192 ounces in a week in 1871. Another company sank fifty to seventy feet to the deep channel and got large pay. Most of the deep channel never bottomed. Little work in 1875. Some work going on in 1885.

Skeleton Creek.—A tributary of Mansen Creek.

Elmore Gulch.—Some gold obtained. Mining profitable in 1874.

Black Jack Gulch.—A tributary of Mansen Creek. Five men in 1871 made \$200 a day continuously here.

Ma
appea
Kil
May
Yield
Ful

who h
its trib
on all t
three a
Natio
near he
Parsn
nerative
tributari
Iroquo
reported
Peace
To the c
prospect
course, M

(Facts
what grea
Annual R
Stikine
but little
extended t
was found
on Stikine
two to thre
ceased, poss
ces appear
sent river-b
Creek, exten
lic work.
Tahl-tan,
worked for
(arquerite)
Tooya, or
serious work

Mansen River.—(Below the lake). Diggings reported in 1871 but appear to have been soon abandoned.

Kildare Gulch.—Yielded a little gold in 1881 and 1882.

May Creek.—(Osalinka of maps). A tributary of Omenica River. Yielded a little gold in 1882.

Finlay River.—This large river is well thought of by all the miners who have seen it, but has not been thoroughly prospected, and none of its tributaries above Omenica River have been examined. Fine gold on all the bars, and in 1861, on a bar three miles up from its mouth, three and four ounces a day to the hand obtained.

Nation River.—A tributary of the Parsnip from the west. Streams near head-waters known to be auriferous but very little prospected.

Parsnip River.—The lower portion of this river proved highly remunerative for a limited time. Bar mining and fine gold. Its eastern tributaries appear to be well worth prospecting.

Iroquois Creek.—Between Forts St. James and McLeod. Gold reported. (Report, 1875-76, p. 257.)

Peace River.—Formed by the confluence of the Parsnip and Finlay. To the east of the Rocky Mountains, gold was found by a couple of prospectors from Quesnel in 1861. Scale and flour gold along the whole course. Many of the bars at first yielded \$10 to \$15 a day to the hand.

Cassiar District.

(Facts relating to gold mining in Cassiar district are given in somewhat greater detail, and in connexion with its geological features, in Annual Report, 1887, Part B.)

Stikine River.—Gold discovered 1861. Very fine gold all along river, but little profitable work below Clearwater. The good ground extended thence to Grand Cañon, above Telegraph Creek. Coarse gold was found in a few places above Telegraph Creek, in the cañon. Bars on Stikine at first averaged \$3 to \$10 a day to the man, and as much as two to three ounces sometimes obtained. Work has now practically ceased, possible earnings being reduced to \$1 to \$3. The circumstances appear to indicate the existence of an old channel above the present river-bed and beneath the basalts, in the cañon. Below Telegraph Creek, extensive benches at various levels which should pay for hydraulic work. (See p. 47 R.)

Tahltan, or First North Fork of Stikine. Heavy gold found and worked for a number of miles up this stream. Pellets of 'silver' (arquerite) also found.

Tooya, or Second North Fork of Stikine.—'Prospects' obtained, but no serious work known to have occurred.

Dease Creek.—Joins Dease Lake from the west. Discovered 1873. Formerly yielded from \$8 to \$50 a day to the hand, from the mouth for about six miles up. Further up, some isolated good claims worked. The bed of the creek is nearly worked out, the ground having been shallow. A few bench claims still yielding fairly. Hydraulic work on a small scale. Gold coarse and generally well rounded; worth \$15 50 to \$16 per ounce.

Thibert Creek.—Joins Dease Lake from the west, near lower end. Discovered 1873. Good ground for about six miles up from mouth. Yield at about same rate as last. Creek bed worked out, but benches and side-ground being worked by hydraulic method and drifting. Gold coarse, worth \$16 an ounce.

Mosquito Creek.—A tributary of the last. Very good 'prospects' have been obtained here; as much as \$40 to a six-foot set of timbers.

Defot Creek.—A tributary of Cañon Creek, which is on the same (west) side of the Dease, with the last. Gold coarse, rough and often full of quartz. Large nuggets, including one of fourteen ounces. Has been, for a limited area, (about a mile in length) one of the richest pieces of ground in the district. The gold is evidently derived from massive deposits of quartz, which occur at the head of the creek, at a considerable elevation.

Beady Creek.—Dease River, east side. A little bar-mining in 1874 and 1875, but nothing of importance developed.

Eagle River.—Dease River, east side. Good prospects, but no mining carried on.

McDame Creek.—Enters Dease River from the north. Discovered 1874. Highest earnings from \$6 to \$100 a day, when mining at its best. Gold coarse, worth \$17 75 to \$18 an ounce. Comparatively little work done in the stream-bed, the best ground being an old high-level channel, worked in places for fifteen miles up. Bench claims run for about seven miles up. Valley wide, with numerous tributaries, most of which yield gold. Gold has also been found on heads of streams flowing to the north, beyond the McDame water-shed.

Snow Creek.—A tributary of the last. Discovered 1875. The richest single claim in Cassiar was near the mouth of this creek, and paid for a week 300 ounces for six or eight men. Seventy-two ounces washed from one pan of dirt in 1876. Now nearly worked out. Gold worth \$18 an ounce. Decomposed rusty quartz containing gold, found on this creek.

Quartz Creek.—A branch of Trout Creek, tributary of McDame Creek. Discovered 1875. Highest average \$5 to \$20 a day. Gold coarse and rough, with quartz attached. Nearly worked out.

Rosella Creek.—Tributary of McDame Creek. Discovered 1876.

High

Aband

Pat

\$20,

Aband

Dens

Gold w

Gold

Gold w

Slate

Gold w

Son r

Earning

Abandon

Third

diggings

Spring

made. C

done.

Fall Cr

Rapid

tained, bu

French

gold obtain

Walker

five miles

Probably n

have never

Black, T

and said to

obtained on

waters, but

Lower L

Thibert and

good deal of

The best kn

about fifty

Bed-rock Ba

McCulloch's

Upper L

and more or

beds resting

can be obtain

Highest average per day \$5 to \$15. Gold worth \$18.25 an ounce. Abandoned.

Patterson Creek.—Discovered 1877. Highest average per day \$5 to \$20, generally paid 'wages' at \$6. Gold worth \$18 an ounce. Abandoned.

Dennis Creek.—Discovered 1877. Returns about same with last. Gold worth \$18.25 an ounce. Abandoned.

Gold Creek.—Discovered 1877. Best earnings per day \$5 to \$50. Gold worth \$18 an ounce. Bench and creek diggings. Abandoned.

Slate Creek.—Discovered 1877. Highest average earnings \$10 a day. Gold worth \$18 an ounce. Bar diggings. Abandoned.

Son r's Creek, or First North Fork of McDame. Discovered 1876. Earnings of \$10 to \$100 a day made. Gold worth \$18 an ounce. Abandoned.

Third North Fork of McDame.—Discovered 1877. Creek and hill diggings. Abandoned.

Spring Creek.—Discovered 1877. Earnings of \$10 to \$20 a day were made. Gold worth \$18.25 an ounce. Principally hill diggings. Abandoned.

Fall Creek.—Discovered 1877. Some gold obtained. Abandoned.

Rapid River.—Dease River, below McDame Creek. Prospects obtained, but no mining of importance.

French Creek.—Dease River, north side, below McDame Creek. Some gold obtained.

Walker Creek.—Discovered 1876. Said to be distant about seventy-five miles in an easterly direction from mouth of McDame Creek. Probably a tributary of Black River. Some gold obtained, but results have never been satisfactory.

Black, Turnagain or Muddy River.—Reached by same trail as last, and said to be about ninety miles distant from McDame. Fine gold obtained on bars, and supposed that coarse gold may occur near headwaters, but has not yet been discovered.

Lower Liard River.—(Below confluence of Dease).—Here Messrs. Thibert and McCullough first discovered gold, and for some years a good deal of work was carried on upon river-bars, the gold being fine. The best known bars, in order down the river, were—*Porcupine Bar*, about fifty miles below the mouth of the Dease, north side of river; *Bed-rock Bar*, about five miles below last, on south side of river; *McCulloch's Bar*, near site of Old Fort Halkett.

Upper Liard River.—(Above confluence with Dease). 'Prospects' and more or less river-bar mining in a number of places. In gravel-beds resting on old rocks at the Lower Cañon, 'wages' at \$4 a day can be obtained with rocker.

The following creeks in Cassiar District, which are reported as having yielded some gold, I am unable to place:—*Mitchell's Creek*, *Brown's Gulch*, *Poorman's Gulch* or *Creek*, *Fred Hart Creek*.

Yukon District.

This district is beyond the northern boundary of the province of British Columbia, which is constituted by the 60th parallel. A summary of the few facts relating to its placer deposits is, however, included here. The two localities first referred to below, are naturally attached to the Cassiar district, and have been prospected from that district.

Sayyee Creek.—Joins Upper Liard from the west, about fifty-five miles above the Frances. Good prospects were obtained here in 1875, of coarse gold. Little work has been done, but reported that the paying ground gave out.

Finlayson River.—Joins Frances Lake from the west. Prospecting done at mouth, ten or twelve years ago, gave earnings at \$8 to \$10 a day. Many streams in this region have a very favourable aspect, and have never been prospected. (Report 1887, p. 113 B.)

Lewes River.—Gold discovered, 1880. Mining began, 1881. Remunerative river-bars occur all along this river below the mouth of the Tes-lin-too or Newberry, but the richest so far worked are within a distance of seventy miles below this point. Many bars yield \$10 a day to the hand. Cassiar Bar, which has proved the best, is said to have yielded \$30 a day to the hand in some cases, but is now worked out. Gold all fine. The whole length of this and other rivers will, doubtless, eventually be worked when the county becomes more accessible. (Report 1887, p. 180 B.)

Tes-lin-too River.—A tributary of the last. Bars similar to those of the Lewes as far up as Tes-lin Lake. (See Report 1887, p. 156 B.)

Ni-Sutlin-hi-ni.—The main feeder of Tes-lin Lake. Similar river-bars. A little work has been done on them. (Report, 1887, p. 156 B.)

Big Salmon River.—A tributary of the Lewes. River-bars, with more or less fine gold, along whole course, but no good paying bars yet worked. (Report, 1887, p. 152 B.)

Upper Pelly River.—Remunerative river-bars discovered in 1882, and some of these, between the mouth of the Lewes and the Macmillan, have been worked. More or less gold on bars as far up as they have been prospected. (Report, 1887, p. 134 B.)

Ross River.—A tributary of the last. This stream is believed to be the one on which several miners made at the rate of \$18 a day some years ago. (Report, 1887, p. 134 B.)

Stewart River.—Tributary of Pelly or Yukon, from the east. Gold discovered, 1885, and in this year and 1886 as much as \$100 a day to

Leech R.
miles of its
argillites.

Seym
but wor
Prosp
Lake. t
survey
Homa
known.
Lorne
and narr
ground
experien
\$18,000;
Bone's
1887.
Douglas
and a littl
Other st
obtained in
placer-min

the hand made on river-bars. Probably \$100,000 worth of gold already obtained. Gold all fine, but reported to become somewhat coarser far up the stream. Very little black sand found with the gold, but garnet sand common. More or less platinum associated with the gold here and on all the streams in the Yukon basin.

Sixty-mile Creek.—Between Forty-mile Creek and Stewart River, west side of Pelly or Yukon River. Pieces of quartz containing gold found in drift. Prospects of alluvial gold found, but no placer work carried on.

Forty-mile Creek.—Tributary of Pelly or Yukon, from the west. Discovered, autumn of 1886. Coarse gold and nuggets found here, the only place, so far, in the Yukon district. Earnings as high as \$100 a day to the man occasionally. A number of miners making \$14 a day in 1887, but in 1888 earnings small, owing to continued high water. The stream is said by the miners to be a 'bed-rock creek,' i.e. one without deep drifting or sinking ground.

Region of the Coast Ranges and Skeena River.

Seymour Creek.—Burrard Inlet. Some gold got here at one time, but work abandoned.

Prospect Creek.—East Branch Homathco River, above Tatlayoco Lake. Some fine gold found here by men connected with C. P. Ry. survey in 1875.

Homathco River.—Prospects obtained, but no mining done so far as known.

Lorne Creek.—Skeena River; discovered 1883. Valley reported deep and narrow. Gold obtained principally in bed of creek, though side-ground and benches favorably spoken of. Much trouble has been experienced from floods. Yield reported in 1884, \$17,000; 1885, \$18,000; 1886, \$12,000; 1887, \$3,795.

Bone's Gulch.—Skeena River. Producing a little gold in 1886 and 1887.

Douglas Creek.—Kitsumgalum, Skeena River. Prospecting in 1886 and a little gold got, but work abandoned.

Other streams flowing from Cascade Range.—Prospects have been obtained in a number of these, but details are wanting and no important placer-mining has been developed.

Vancouver Island.

Leech River.—This stream has proved auriferous for four or five miles of its length, where it flows along the strike of a belt of slaty argillites. It was discovered in 1864, and within a few years thereafter

yielded gold to the value of \$100,000 to \$200,000, according to various estimates. Gold often coarse and nuggety, and earnings as high as \$34 a day to the rocker were reported in 1864. The rich ground found in the present river-bed is supposed to be exhausted, though desultory mining has been carried on ever since at intervals. A good deal of 'crevicing' has been done on bed-rock. Benches rather extensive and all contain more or less fine gold. The "Gordon Hydraulic Mining Company (Limited)" have lately acquired an extensive tract about half-way between Sooke River and the North Fork of Leech River, and are putting in hydraulic machinery. For details on Leech River see Report, 1876-77, p. 95.

Sooke River.—(Below its junction with Leech River).—Fine gold only found here and probably derived from Leech River.

Goldstream Brook.—Runs on strike of Leech River slates, further east. 'Colours,' but no pay, found here.

Jordon River.—Discovered and worked about the same time with Leech River. Coarse gold obtained, largely by 'crevicing.' It has been estimated that \$30,000 worth of gold was taken out within a few months after discovery.

Nanaimo River.—Attracted some notice in 1877, but has never proved rich. A few Whites and Chinese work here almost every year, making small wages. They follow the river up to its head, which is not far from that of China Creek, Alberni Canal.

San Juan River.—Entering San Juan Bay at about twenty miles above salt-water. Some coarse gold obtained by 'crevicing' on a short length of this stream. Formation reported to be slate.

Cowichan River.—Mr. Brown, of the Vancouver Island Exploring Expedition, (1864) reports gold on all the bars of Cowichan River in quantities of one quarter of a cent to three cents to the pan.

Foley's Creek.—(Cowichan Lake?) Mr. Brown reports: "'Prospects' to \$2 per day and one which ought, to an experienced miner, to pay from \$5 to \$8 per diem."

China or Atlat Creek.—Situated about seven miles down Alberni Canal from its head, on south side; not named on chart. Discovered about 1871 and worked steadily for three years, chiefly by Chinese. A little work still going on. Paid for a distance estimated at twenty miles up from mouth and gold found to sources. Earnings of Chinese supposed to have been about \$5 a day. Some prospecting for 'quartz,' with hopeful results, has been done in mountains about this creek.

Awatsish Creek.—At 'First Narrows,' lower down inlet than last, but rising in the same mountains with it. Some coarse gold has been found, but ground very bouldery, and no serious work has been attempted.

No p
gold is
are met
79, p. 33

The pr
from plac
metals, p
of Cariba
reputed to
considered
included in
in the subj

Mitchel
vein, refe
Chart No.
published
this place

Bear River.—Head of Clayoquot Sound. An excitement about this place got up in 1862 and 1863, and again in 1887, when twenty to thirty Whites and many Chinese visited it. Fine gold found but not in paying quantity. Mr. Buttle, of Vancouver Island Exploring Expedition, reported occurrence of coarse gold on one of the sources of this river.

Gold River.—Nootka Sound. Prospected on several occasions. Fine gold found, but not in paying quantity.

Cape Commerell.—North end of Vancouver Island. Beaches with black sand containing gold. Little has yet been done to ascertain whether the gold is in remunerative quantity.

Cape Cook.—Two smaller streams on outer end of this cape, and one on south side, give 'prospects,' but bars quite limited and never worked.

Ou-ou-kinsh Inlet.—A small stream here known to yield a fair 'prospect.'

Streams tributary to Puntledge Lake and a little stream just east of Cape Commerell are also known to contain gold in small quantity.

For some of the above notes relating to Vancouver Island, I am indebted to Mr. J. Jacques.

Queen Charlotte Islands.

No paying gold-placers have ever been found in these islands, though gold is present in fine scales in deposits of magnetic iron sand, which are met with about Cape Fife, and possibly elsewhere. (Report 1878-79, p. 33 R.)

GOLD (AURIFEROUS VEINS).

The principal known occurrences of gold-bearing veins, as distinguished from placer deposits, are enumerated in the table of assays of the precious metals, pp. 76 R to 79 R. In Mr. Bowman's report on the Mining District of Cariboo about 100 localities of quartz-veins in that district, known or reputed to be auriferous are catalogued and described, and these it is not considered necessary here to repeat. A few localities only which are not included in the table of assays, or in Mr. Bowman's report, are mentioned in the subjoined short supplementary list.

Mitchell or Gold Harbour, Queen Charlotte Islands.—Rich gold-bearing vein, referred to on p. 17 R, exact position marked on Admiralty Chart No. 2168, and in Geological Map of Queen Charlotte Islands, published in Report for 1878-79. Mr. Woodcock, who again prospected this place in 1878, informed me that the original vein was probably

not over three feet thick, and appeared to be worked completely out in an excavation thirty feet long by twelve feet deep. The vein was quite vertical. Green crystalline country-rock, probably diabase. Mr. Woodcock found some small quartz seams about a mile and a-half from the original locality which contained visible gold.

Sebastopol Creek.—About sixty miles up the Skeena River and above Kitanlas. "Sebastopol ledge," situated about two miles up the stream. Assay by Mr. Tiernan, of Victoria, reported as giving—gold, \$42.18, silver, 13.47 to the ton.

Clinton.—Loose specimens of hematite and quartz containing visible gold, found here in 1836, but not traced to their origin. Reported to yield gold to the value of \$300 to the ton on assay. (Report of Minister of Mines of B. C., 1886, p. 207.)

Near Cottonwood Creek.—(Near Toad Mountain, West Kootanie.) A number of claims located on free-milling gold-ores; reported to be rich, and high assays are quoted by Mr. Sprout. (Report of Minister of Mines of B. C., 1888, p. 299).

Near Lardo River.—(West Kootanie.) Free-milling gold-quartz, reported to contain \$4 to the ton, has been found. (Report of Minister of Mines of B. C., 1888, p. 304).

Findlay Creek.—(East Kootanie.) Free-milling gold-quartz reported. (Report of Minister of Mines of B. C., 1888, p. 307).

Big Bend Region.—In addition to the places mentioned in the table of assays, it may be stated that rich specimens of gold-bearing quartz derived from the "Homestead" and "Big Bend" claims, have been received.

Vicinity of Rock Creek.—Free milling gold-ores reported here, in addition to silver-ores. Rich hand specimens received. Referred to p. 68 B.

Monashee Mine.—Between Cherry Creek and Kettle River. Free gold reported. Referred to p. 68 A.

The following claims covering veins known or reported to contain gold, generally in association with some silver, are in the vicinity of the Lower Fraser, "Teague's" Harrison Lake; "Seymour Creek," "Lottie," "No Surrender" and "Vancouver," at various places on or near Burrard Inlet. I am unable to furnish any authentic particulars respecting these.

Texada Island.—Gold-ores recently discovered here, and many claims recorded. No particulars yet available. See p. 74 A.

T
eithe
See
purp
have
This
querit

Vi
often
jected
Sim
native
ing tw
Miss
found
Simi
silver c
Nico
washing
prove to
siderabl
Tahl-
(Report

In the
to enumer
coal-fields
various wa
information
of the Surv
to mention

Cowgitz,
(See also R
South Sid
out-crop.
Ya-koun
18 feet thick

SILVER.

The principal known localities of silver-ores have already been enumerated, either on pp. 56 R to 74 R, or in the Table of Assays, pp. 76 R to 79 R. See also some references under Copper, p. 101 R. It would serve no useful purpose to endeavour to name the many hundred individual claims which have lately been recorded on silver-ores, even if it were possible to do so. This supplementary list contains known occurrences of silver amalgam (arquerite) or native silver, so far found only in connexion with gold-washings.

Vital Creek, Omenica District.—Considerable quantities of arquerite, often in nuggets, found here in the placer-mines. A specimen subjected to analysis contained 83.30 per cent. of silver. See p 73 R.

Similkameen River.—(Near Vermilion Forks.) Small quantities of native silver or arquerite found in gold-washings, occasionally weighing two to three pennyweights. (Report 1877-78, p. 162 B.)

Mission Creek, Okanagan Lake.—Pellets of native silver or arquerite found occasionally with the gold. (Report 1877-78, p. 162 B.)

Similkameen River, near the Boundary-line.—Small pieces of native silver or arquerite occasionally found in gold-washings.

Nicoamen, Thompson River.—Native silver occasionally found in gold washings. Small pieces of this material have been obtained and prove to be silver and not arquerite. In 1858 and 1859 pieces of considerable size are reported to have been discovered.

Tahl-tan River, Cassiar District.—Arquerite found in gold-washings. (Report 1887, p. 80 B.)

COAL AND LIGNITE.

In the following list of localities of coal and lignite, no attempt is made to enumerate the very numerous occurrences and outcrops in the well known coal-fields of Nanaimo and Comox, nor even to mention individually the various workings upon these, which have already been described, and for information upon which the foregoing pages, as well as the various Reports of the Survey, must be consulted. In the less known regions, I have endeavoured to mention all the scattered discoveries which have come under my notice.

Queen Charlotte Islands.

Cowgitz, Skidegate Inlet.—Anthracite coal referred to on page 85 R. (See also Report, 1878-79, p. 71, B, 1872-73, p. 56.)

South Side of Skidegate Inlet.—Anthracite coal, much disturbed small out-crop. (Report 1878-79, p. 68 B.)

Ya-koun River.—Bituminous coal of good quality and reported to be 18 feet thick, referred to on p 86 R. (See also Report 1887, p. 17 T.)

Chin-oo-kun-dl Brook.—Lignite. Impure and thin seams. (Report 1878-79, p. 85 B.)

Ya-kan Point.—Lignite. Irregular deposits on the beach. (Report 1878-79, p. 86 B.)

Skon-un Point.—Lignite. Beds of some thickness on the beach. (Report 1878-79, p. 86 B.)

Ma-min River, Masset Inlet.—Lignite in thin seams six miles up this river. (Report 1878-79, p. 88 B.)

Naden Harbour.—Stream on east side. Drift lignite in the brook. (Report 1878-79, p. 89 B.)

Vancouver Island.

Nanaimo District.—Bituminous coal which has been worked for many years. Described on p. 90 R. (See also Reports 1876-77, p. 170, 1871-72, p. 81, 1873-74 p. 96, 1874-75 p. 82.)

Comox District.—Bituminous coal, now being opened up on an extensive scale. Described on p. 89 R. (See also Reports 1876-77 p. 161, 1871-72 p. 76, 1872-73 p. 32, 1873-74 p. 95.)

Campbell River.—This stream flows into Discovery Passage. Bituminous coal reported on it about twelve miles inland. (Report 1886 p. 19 B.)

Kuhushan Point.—Coal reported in stream which reaches the coast, half a mile south of this point. (Report 1886, p. 18 B.) This locality and the last are included in the northern continuation of the Comox coal-field.

Forward Inlet area, Quatsino Sound.—Bituminous coal. Thin seams only found as yet, noted on p. 86 R. (See also Report 1886, p. 83 B.)

Koprino area, Quatsino Sound.—Requires exploration by boring. No coal outcrops known. Referred to on p. 87 R. (See also Report 1886, p. 86 B.)

Koskeemo area, Quatsino Sound.—Bituminous coals, noted on p. 86 R. (See also Report 1886, p. 89 B.)

Suquash.—Coal. Noted on previous pages (p. 80 R, 88 R.) (See also Report 1886, p. 62 B., *et seq.*)

Kliksiw River.—Coal seam near here of sixteen inches in thickness. (Report 1886, p. 62 B, *et seq.*)

Kiwuk River and vicinity.—Bituminous coal in thin seams. (Report 1886, p. 62 B. *et seq.*) This locality, and that preceding it are included in the Suquash coal-field.

Saanich Inlet.—Thin coal-seams found in several places in this vicinity, but none, so far, of value. Included by Mr. Richardson in Cowichen area. (Report 1876-77, p. 187.)

Sooke.—At the entrance of the harbour, and elsewhere in that vicinity, lumps of coal or lignite found upon beaches. Probably derived from Tertiary rocks of which an area there occurs. A boring was at one time made to a depth of 139 feet, but did not pass through any coal. (Report 1874-75, p. 83, 1876-77, p. 190.)

Head of Alberni Canal.—Coal is reported here and rocks of the Cretaceous coal-bearing series occur, but have not been fully examined.

Clayoquot Sound and Ucluelet.—Bituminous coal found in several places in this vicinity, but no geological examinations yet made.

Cowichen Bay.—Small fragments of anthracitic coal have been found in sandstone here by Mr. Richardson.

Koquesila River.—Specimens of impure anthracite obtained some distance up this stream. A little prospecting work has been done here.

Mainland of British Columbia.

Sandstone River.—North-east side Malaspina Strait. Coal or lignite, in thin irregular layers. There is a considerable area of sandstones etc. here, probably of Cretaceous age, but a small thickness only is exposed in the river. (Report 1886, p. 31 B.)

Vicinity of Vancouver.—Burrard Inlet. Two series of lignites or lignite-coals come to the surface here. The upper series is seen near the Brewery, Brewery Creek, half a mile south of False Creek and elsewhere, both east and west of that point. The lower series is seen near Ostranders Point, Stanley Park, and again on the line of strike, to the eastward, within half a mile to a mile west of Hastings. All the seams so far found are quite thin, seldom exceeding a few inches.

Kanaka Creek.—Near Haney Station, C. P. Ry. At about four miles above the mouth of this stream, seams a few inches thick, of coal or lignite-coal occur.

Warnock Creek.—Near Warnock Station, C. P. Ry. Two-thirds of a mile up from mouth of creek, small seams of coal or lignite.

Stave River.—Half a mile above mouth of river, a small seam of coal or lignite.

Mission Hills.—About five miles up Stave River. Some fragments of coal or lignite reported, but have not been traced to source.

Stalets Mountain.—Near Sumass Mountain. At this place, about five miles south of Frank Wade's store and landing, a seam over twenty inches in thickness of excellent coal has been found.

Chilliwick River.—Irregular 'bunches' of good bituminous coal found in sandstones about three miles and a-half south-west of Chilliwick village (Centreville) near the road from that place to Capt. John's village, and about half a mile north-east of the road-crossing of

the river. Many other occurrences of similar coal are known in the Cultus Lake range of hills, which skirts the Sumass valley. (See analysis No. 19, p. 98 R.)

(The above notes on places near the Lower Fraser are supplied by Mr. A. Bowman, and are given at greater length, as they are not elsewhere available in published form.)

Junction of Nicola and Coldwater Rivers.—Coal, noted on page 96 R. (Report 1877-78, p. 125 B.)

Coldwater River.—Coal, of same formation with last, in several places. (Report 1877-78, p. 126 B.)

Quilchena.—On McDonald's River, which enters Nicola Lake at this place, at about three miles and a-half from the lake. Lignite of poor quality. Thickest seam exposed about two feet.

Guichon Creek.—Joining Nicola River from the north. Lignite of good quality found three to four miles up this stream, but bed not fully exposed.

South Fork of Similkameen River.—(Above the mouth of the Pasayten) Lignite reported in micaceous sandstone. (Report 1877-78, 133 B.)

South Fork of Similkameen River.—(Four miles above Vermilion Fork) Lignite. (Report 1877-78, p. 130 B.)

South Fork of Similkameen River.—(Quarter of a mile above Vermilion Fork, south bank.) Lignite or lignite-coal of good quality, which has been worked lately to a small extent for local use. Where opened, shews an upper seam nine feet thick, with a few small shaly partings, below this, some feet of mixed lignite and shale, and then a seam of clean lignite-coal four feet or more in thickness, the bottom being below water-level.

Tulameen River.—(Three miles above Vermilion Fork) Lignite seven feet thick with one shaly parting of three inches. (Report 1877-78, p. 132 B.)

Rock Creek.—(Half a mile from mouth on Kettle River.) Lignite, thickness not known.

Kamloops.—(Three miles south-west of town.) Good coal in base of Tertiary rocks, but so far thin seams only found. See p. 96 B. (Summary Report, 1888, p. 5.)

Crow Nest Pass.—Rocky Mountains. Bituminous coal, near Marten Creek. See pp. 93 R, 97 R. (Report 1886, p. 69 B., 1887, p. 12 R.)

North Kootanie Pass.—Rocky Mountains. Coal in thin seams on western slope of "West Summit." The coal actually observed here is not of workable thickness, but the measures are the same with those of Marten Creek, and it is highly probable that important coal-seams may be found here. This is the nearest part of the "Elk River Cretaceous Trough" to the Kootanie valley, from which it is only twelve

mi
64
in s
bein
G
mit
seam
Th
on th
Rock
impor
being
British
Koot
loose p
Nort
minous
Fraser
bridge.
Nicola
impure.
Hat C
1877-78,
Fraser
nel. Lig
quality.
Lower
formation
Upper
several pl
feet. (Re
Blackwa
along inte
Chilacco
Nasco R
1875-76, p
Ko-has-g
of good qu
76; 1877-78
Boyd's, on
bed, 6 to 10
Bear River
Coal reporte

miles distant by the valley of the Wigwam River. (Report 1885, p. 64 B.)

Fording River.—A tributary of Elk River, Rocky Mountains. Coal in several thin seams, the thickest seen in small natural exposures being two feet. (Report 1885, p. 109 B.)

Green Hills.—Elk River valley, Rocky Mountains. Near the summit of these hills, about four miles south of the last locality, a coal seam several feet in thickness, poorly exposed.

The above three localities, with that of Marten Creek, are all situated on the Elk River Cretaceous Trough, on the western water-shed of the Rocky Mountains. There can be little doubt that there is here an important coal-field. Other Cretaceous areas in the Rocky Mountains being to the east of the water-shed are not included in the province of British Columbia. (See Report 1885, with accompanying map.)

Kootanie Valley near Bull River.—Lignite. So far found only in loose pieces. (Report 1885, p. 151 B.)

North Thompson River.—(Forty-five miles above Kamloops.) Bituminous coal of good quality in thin seams. (Report 1877-78, p. 113 B.)

Fraser River.—(East side, a short distance above the cantilever bridge.) Lignite. Thin seams.

Nicoamen, Thompson River.—Lignite. Seams so far found thin and impure.

Hat Creek, near Marble Cañon.—Lignite forty feet thick. (Report 1877-78, p. 140 B.)

Fraser River.—Between Soda Creek and Fort George, and at Quesnel. Lignite seams frequently exposed. That at Quesnel of poor quality. See p. 97 R. (Report 1875-76, p. 257.)

Lower Nechacco River.—(East of Fraser Lake.) Extensive Tertiary formation, but drift-lignite only known. (Report 1876-77, p. 82.)

Upper Nechacco River.—(South of Fraser Lake.) Lignites seen in several places about eight miles south of the lake. Thickest bed four feet. (Report 1876-77, p. 82.)

Blackwater River.—Drift lignites at Upper and Lower Cañons and along intervening portion of river. (Report 1875-76, p. 256.)

Chilacco River.—Drift lignite only found.

Nazco River.—Drift lignite found near Cinderella Mountain. (Report 1875-76, p. 254.)

Ko-has-gan-ko Stream.—South-west of Tanyabunkut Lake. Lignite of good quality, four feet or more in thickness. (Report 1876-77, p. 76; 1877-78, p. 48 G.)

Boyd's, or Cold Spring Home.—Lightning Creek, Cariboo. Lignite bed, 6 to 10 feet thick, and of fair quality.

Bear River.—(Near crossing of old C. P. Ry. surveyed line, lat. 54°). Coal reported and said to be about eighteen inches thick.

Parsnip River.—Lignite in place, and abundant in loose pieces. (Report 1875-76, p. 71.)

Kitsequecla, Skeena River.—Impure coal observed in Cretaceous rocks. (Report 1879-80, p. 103 B.)

Babine Portage, near Babine Lake.—Impure coal, observed. (Report 1879-80, p. 104 B.)

Upper Skeena.—Two localities, 9 and 20 miles respectively above Skeena Forks. Impure coals, like the two preceding. (Report 1879-80, p. 105 B.)

Watsonkwa River.—(Eighteen miles above Skeena Forks.) Bituminous coal, reported to occur in quantity. Noted on p. 93 R. (Report 1879-80, p. 105 B.)

Pine River Cañon.—(Five miles above Lower Forks). Peace River district. Bituminous coal in four thin seams, the thickest being 2 feet. (Report 1875-76, p. 53.)

Coal Brook.—East Branch of Pine River. Peace River district. Coal in several thin seams. (Report 1879-80, p. 117 B.)

Cañon of the Mountain of Rocks.—Peace River. Bituminous coal in thin seams, of which the thickest observed is 2 feet. (Report 1879-80, p. 119 B.)

Tahl-tan River.—Cassiar district. Lignite reported to occur in Tertiary rocks.

Rapid River, Cassiar.—Lignite-coal about two feet thick reported near mouth.

Dease River.—(Eight miles above mouth.) Cassiar district. Lignite in thin beds. (Report 1887, page 95 B.)

Liard and Frances Rivers.—(Below and above their confluence.) Yukon district. Lignite. Thickest observed bed 3 feet. (Report 1887, p. 111 B.)

Chilkat Pass.—(Near the head of Chilkat River, 40 or 50 miles north-west of head of Chilkat Inlet.) Bituminous coal, which, in specimens examined, seems to be of good quality. Reported to occur in quantity in an area of sandstones, shales, etc., which runs in a north-westerly direction.

Leaves River.—(Lat. $62^{\circ} 15'$, long. $136^{\circ} 25'$.) Yukon district. Lignite coal. Several seams, but none observed of great thickness. (Report 1887, p. 148 B.)

Pelly, or Yukon River.—At Coal Creek, five miles below Forty-mile Creek, on east side of river. Two seams of coal or lignite-coal, reported by W. Ogilvie, of 5 and 7 feet in thickness respectively.

IRON.

South-west Shore, Texada Island.—Magnetite. Described on p. 99 R. (Report 1886, p. 36 B.)

North-east Shore, Texada Island.—Magnetite. Irregular masses in limestone, with a more or less stratiform aspect. Thickest mass seen, 4 feet. (Report 1886, p. 39 B.)

Island in the Walker Group.—Magnetite of exceptionally rich quality. This occurs on a small rocky inlet near the north end of the Walker Group, in Queen Charlotte Sound. The deposit has not been examined. (Report 1872-73, p. 82.)

Rivers Inlet.—About 25 miles up the inlet on the north side. Magnetite, resembling the Texada ore. Deposit said to be extensive.

Entrance of Rivers Inlet.—West side of Fitzhugh Sound. Magnetic iron ore reported. (Report 1873-74, p. 101.)

Harriet Harbour, Queen Charlotte Islands.—Magnetite. Noted on p. 101 R. (Report 1878-79, p. 54 B.)

North side Skincuttle Inlet, Queen Charlotte Islands.—Magnetite. (Report 1878-79, p. 53 B.)

Cape Commerell.—North end of Vancouver Island. Magnetic iron sands along the shores, but scarcely in sufficient quantity to be of economic importance. (Report 1886, p. 77 B.)

Knight Inlet.—One mile up river, at head of inlet, on left bank, 1200 feet up mountain. Magnetite reported. (Report 1873-74, p. 100.)

Opposite Seymour Narrows.—About six miles inland from Menzie's Bay. Iron ore. Reported to be a considerable deposit. (Report 1873-74, p. 101.)

Skidegate Inlet, Queen Charlotte Islands.—Clay ironstone in numerous and large nodules in several places in the coal-bearing rocks.

Baynes Sound Mine, Comox.—Clay ironstones in considerable quantity in association with the coal seams. Two specimens, examined by Mr. Hoffmann, gave 36.83 and 29.78 per cent. respectively of metallic iron.

Alberni Canal.—Magnetite. About a mile below China or Atlat Creek. Considerable veins traversing the rock on the shore.

Sooke.—(East side of harbour). Magnetite. Noticed on page 100 R. (Report, 1886, p. 17 T.)

Sooke.—(near the last). Hematite. Seen in exposure on the beach, but deposit apparently not extensive.

Near Hope.—A good specimen of magnetite. Reported as occurring about ten miles from Hope.

Near Nicoamen.—Ravine at the mill, about half a mile below Nicoamen. Vein or irregular deposit of magnetite with iron pyrites. The latter in such large quantity as to render the ore valueless.

Loadstone Mountain.—Near old "Brigade Trail," from Tulameen River to Hope, nine miles south-west of mouth of Otter River. Magnetite in numerous veins, traversing an intrusive mass of diorite. Veins actually observed, near the summit of the mountain, about six inches in thickness.

Iron Mountain.—On Nicola, near mouth of Coldwater River. Specular iron-ore in numerous small veins. Veins several feet in width reported but not actually observed. (Report, 1877-78, p. 122 B.)

Similkameen Valley.—(Three miles above Keremeos, north side.) Schistose hæmatite found. (Report, 1877-78 p. 86 B.)

Bull River Cañon.—Kootanie Valley. Massive hæmatite, occasionally coloured with copper carbonate. Found loose in considerable quantity. (Report, 1885, p. 151 B.)

Cherry Bluff, Kamloops Lake.—Magnetite, in numerous, irregular veins traversing a greenstone mass. Some veins observed as much as three feet in thickness. The ore is of excellent quality. Specimens were found to contain 66.83 per cent. of metallic iron, with very little sulphur or phosphorus. (Report, 1877-78 p. 118 B.)

Watkinson's, Fraser River.—(about 23 miles above Lytton.) Magnetite. Vein said to be twenty feet in thickness,

Quesnel.—Clay ironstone in Tertiary rocks, often converted into hæmatite by the natural combustion of adjacent lignite-bed. Similar clay ironstones occur in many places in the Tertiary rocks of the Province in greater or less quantity.

COPPER.

(See also *Table of Assays of ores of the Precious Metals*, pp. 76 R to 79 R.)
Near head of Salmon Arm, Jarvis Inlet.—Deposit of bornite and copper-pyrites. (See p. 102 R.)

Knight's Inlet.—Ore similar to the last, very rich in hand specimens, locality not examined.

Entrance to Howe Sound.—(Three miles north of Atkinson Point Lighthouse) Copper pyrites found in 1865, and a considerable amount of prospecting work done at one time, but now abandoned.

Texada Island.—(Malaspina Mine.) Copper- and iron-pyrites in gangue of calcite and quartz. Accessory minerals, andradite, tremolite, chlorite and molybdenite. See p. 102 R. (Report 1886, p. 34 B.)

Sansome Narrows.—Copper-pyrites. Some prospecting work done a number of years ago, but now abandoned. The ore appears to follow cleavage-planes in the rock.

South-west side Dean Canal.—Specimens of vein-stone with yellow and purple copper ores, collected by Mr. Horetzky.

DAW
obs
A
vein
brou
G
pyri
E
kus
pyri
know
natio
Po
Pyrrh
work
Dis
Quartz
Nort
mine,"
(Repor
Copp
of copp
Copp
Islands.
one time
Small
reported
Coast t
covered
copper-py
South
Whip-saw
consisting
silver, ap
1882-83.
said to h
Creek, and
Near he
Forks, Sim
discovered
port of Mi
Tulameen
and occasio
gold washin

Head of Kitimat Inlet.—Small deposit of copper-pyrites and galena observed by Mr. Richardson.

Homathco River.—Entering head of Bute Inlet. Many specimens of vein-stones containing copper-pyrites and some purple ore, have been brought from this river, not examined.

Guarled Islands.—North of Dundas Island, Dixon Entrance. Copper pyrites, small veins only seen.

Ellerslie Channel.—Near Milbank Sound. On the west shore of Nikus Arm some work was done several years ago on a vein containing pyrrhotite or magnetic iron-pyrites and copper-pyrites. This deposit is known as the "Hebrew mine," and appears to deserve further examination as a copper-ore.

Port Simpson.—"Chimseyan Ledge". On the hill behind the village. Pyrrhotite with copper-pyrites in quartz gangue. A little prospecting work done.

Discovery Passage.—(Two miles and two-third south of Otter Point) Quartz vein with copper pyrites, not large. (Report 1886, p. 44 B.)

North side of Skinkuttle Inlet, Queen Charlotte Islands.—"Old copper mine," copper pyrites in small quantity with magnetite. See p. 102 R. (Report 1878-79, p. 53 B.)

Copper Islands, Skinkuttle Inlet.—Small irregular strings and bunches of copper pyrites in many places. (Report 1878-79, p. 52 B.)

Copper Bay.—(Between Cumshawa and Skidegate, Queen Charlotte Islands.) Copper-ores occur here and some prospecting work done at one time. (Report 1878-79, p. 29 B.)

Small Island off Port Frederick, Queen Charlotte Islands.—Copper-ore reported by Captain Stuart, H. B. Co.

Coast two miles east of entrance to Sooke Harbour.—Copper-ore discovered 1864. Shaft sunk 120 feet, now abandoned. Native copper and copper-pyrites. See p. 102 R. (Report 1886, p. 19 R.)

South Similkameen River.—(East bank, six miles above mouth of Whip-saw Creek.) "British Columbia Copper Co's. Claim." Deposit consisting chiefly of copper-pyrites, said to assay \$20 to the ton in silver, appears to be rather irregular. Prospecting work done in 1882-83. The same belt of rock with that containing the copper is said to have been traced in a north-westerly direction to Whip-saw Creek, and to show more or less copper throughout.

Near head of Wolf Creek.—(About twelve miles above Vermilion Forks, Similkameen.) Large body of copper ore reported to have been discovered by Mr. Jamieson, in 1888. Said also to contain silver. (Report of Minister of Mines of B.C., 1888, p. 318.)

Tulameen and Similkameen Rivers.—Native copper in small grains, and occasionally in pellets weighing several pennyweights, found in gold washings.

Between Rock and Boundary Creeks.—Deposit of grey copper ore found in 1888. Reported to be extensive and several claims taken up on it.

Toad Mountain Region.—The silver-ores of this locality contain a large percentage of copper. See p. 102 B.

Jubilee Mountain, Columbia River.—Though referred to on a previous page as deposits of the precious metals composed largely of copper sulphurets. See p. 102 B.

Stump Lake Region.—Many of the ores found here, though chiefly valuable for the precious metals, contain a high percentage of copper.

Brisco Range, Rocky Mountains.—(Opposite lower end of Upper Columbia Lake.) Rich copper-ore consisting of chalcocite, bornite and copper-pyrites. Holds no gold or silver. (Report 1885, p. 27 M.)

Copper Island, Shuswap Lake.—Beds of talcose or nacreous schists, about six feet thick, impregnated with a considerable quantity of copper-pyrites. (Report 1877-78, p. 98 B.)

Copper Creek, Kamloops Lake.—Irregular veins or impregnations of copper-ore in trap rocks. Native copper is also reported to have been obtained here by the Indians in former years. (Report 1877-78, p. 116 B.)

Cherry Bluff, Kamloops Lake.—Copper-ores with magnetite near the west end of the bluff. (Report 1877-78, p. 117 B.)

Watkinson's, Fraser River.—(About 25 miles above Lytton). Grey copper (tetrahedrite) in considerable mass.

Thompson River.—(Rock-slide about six miles above Spence's Bridge, east bank). Copper-ores in irregular deposits, associated with breccia, etc. Apparently unimportant.

Thompson River.—(Six miles below Spence's Bridge). Rich purple ore found loose.

Thompson River.—(Nine miles below Spence's Bridge). A rough fragment of native copper found here, weighing several ounces.

Fraser River, near Hope.—("Murphy's Mine.") Vein containing copper, rather wide and well defined. Said also to contain \$15 to \$45 in silver. A long tunnel run in 1859, and work resumed for a time in 1879.

Fraser River.—(About 30 miles above Fort George). Nugget of native copper weighing several pounds, found loose.

Fraser River.—(Ten miles below Lillooet). Small lumps of native copper found in gold-placers.

Bate's, or 150-mile house, Cariboo Waggon Road.—Nugget of native copper, weighing about 15 pounds, found near here.

Vital Creek, Omenica.—Pellets of native copper found in gold washings.

DAW
Q
in r
loca
littl
B
ing
worl
N
depo
mass
not c

Mo
alread
Distrib
connex
ence sh
Preciou
Moun
holding
Illeci
(See p.
Hot
'carbon
Hend
tainin
Rock
centage
Omen
(See p.
Nass
ardson b
specimen
Lower
centage o
Chilcoti
Percentag
Near In
small vein
(Report 1

Quesnel River, near The Forks.—More than half a ton of native copper, in nuggets, obtained here during gold placer-mining. The precise locality appears to be "Twenty-mile Creek," which enters the river a little below Morehead Creek.

Boulder Gulch, Thibert Creek, Cassiar.—Mass of native copper weighing about 15 pounds, found here. Also found in small nuggets in gold workings on other streams in Cassiar district. (Report 1887, p. 82 B.)

NOTE.—As elsewhere stated, traces of copper ores and small irregular deposits in veins and jointage-planes, or disseminated through rock-masses, have been observed in a great number of places, which it is not considered necessary to enumerate here.

LEAD.

Most of the localities in which ores of lead are known to occur have already been noted in connexion with silver-ores. See pp. 56 R to 75 R. Districts or localities likely to yield a considerable proportion of lead in connexion with silver-mining are, therefore, here merely mentioned. Reference should be made in this connexion to the Table of Assays of Ores of the Precious Metals, pp. 76 R to 79 R.

Mount Stephen, or Tunnel Mountain.—Extensive deposits of galena, holding a large percentage of silver. (See p. 66 R.)

Illecillewaet Region.—Large deposits of galena, often rich in silver. (See p. 63 R.)

Hot Springs Camp, Kootanie Lake.—Large deposits of galena and 'carbonate ores,' often rich in silver. (See p. 61 R.)

Hendryx Camp, Kootanie Lake.—Extensive deposits of galena, containing a moderate amount of silver. (See p. 62 R.)

Rock Creek and Vicinity.—Galena ores, often containing a high percentage of silver. (See p. 68 R.)

Omenica Region.—Veins of galena abundant; generally rich in silver. (See p. 73 R.)

Nas River.—Specimens of galena ore given to the late Mr. J. Richardson by Mr. W. Lyons. Precise locality was not stated, and the specimens have not been tested for silver.

Lower Cañon, Upper Liard River.—Galena in irregular veins. Percentage of contained silver not known.

Chilcotin River.—Specimens of galena collected by Mr. Tiedemann. Percentage of contained silver not known.

Near Indian Village, Cumsheewa, Queen Charlotte Islands.—Numerous small veins in agglomerate, holding a little galena and iron pyrites. (Report 1878-79, p. 77 B.)

Galena is also present in greater or less quantity in a number of the Cariboo mines, but does not appear to be so rich in silver as in the Selkirk region. Of veins in Cariboo in which galena occurs in notable quantity, the "*Home Rule Ledge*" near Barkerville, and the "*Holmes Ledge*" on Break-neck Ridge, Snow-shoe Plateau may be mentioned.

ANTIMONY.

Near Watkinson's, Fraser River.—About two miles below the iron ore locality already mentioned, and say 23 miles above Lytton. Vein about 14 inches wide, containing much stibnite, with quartz and calcite. Contains also traces of gold, and 2·187 ounces of silver to the ton. (Report 1887, p. 58 T.)

Cumshewa, Queen Charlotte Islands.—Specimens containing antimony and arsenic, probably from this place, obtained by Captain Stuart, H. B. Co.

PLATINUM.

Upper Similkameen and Tulameen Region.—Platinum, often in nuggets, observed in a number of localities where gold-mining is carried on. (For the names of these places see p. 104 R.)

Tranquille River, Kamloops Lake.—Found in fine scales with gold. (Report 1877-78, p. 155 B.)

Fraser River.—Mentioned as occurring in very fine scales, with gold, particularly at a place ten miles below Lillooet.

Yukon River.—Found in small quantities, in fine scales, with river-bar gold on all, or nearly all, the tributaries of the Yukon which have been worked.

MERCURY.

Wapta (Kicking Horse) Valley, Rocky Mountains.—"Ebenezar Mine," three miles from Golden.) Bright red cinnabar disseminated in gangue of calcite. Deposit prospected to some extent, but not proved to be of economic importance. (Report 1886, pp. 41 D., 9 T.)

Homathco River.—Cinnabar found here during railway survey. Lode reported well defined and traceable for three-quarters of a mile. Country rock slate. The precise locality is, north side of Homathco River, nearly opposite station 3300, Cambie's Location Survey of 1875.

Fraser River.—Grains of cinnabar obtained in gold-washing near Boston Bar.

Fraser River, 12 miles above Kelly's Lake Creek.—Some way up a stream which flows in from the west, at this place, rich specimens of cinnabar containing native mercury, found.

Vicinity of New Westminster.—A rich specimen of cinnabar, reported by Mr. A. J. Hill, to have been found loose here.

Silver Peak, near Hope.—Globules of native mercury seen in some parts of the silver-ore found at this place.

MOLYBDENUM.

Near head-waters of South Fork Spuzzum Creek, Fraser River.—Molybdenite in quartz veins. Fine specimens received.

Point east of Carrington Bay, Cortez Island, Strait of Georgia.—Molybdenite in small quantities in quartz veins.

Texada Island.—Molybdenite at Malaspina copper mine, in the vein.

Near head of Salmon Arm, Jarvis Inlet.—Molybdenite in association with copper-ore at the locality previously noted. (See p. 152 R.)

Knight Inlet.—Molybdenite reported.

Upper part of Cowichen River.—Specimens of molybdenite brought from here.

Lillooet River.—Specimen of molybdenite received from this vicinity per Mr. A. J. Hill.

STRUCTURAL MATERIALS.

Building Stones, etc.

(Mention is here made merely of several localities in which stone has been quarried, and of some others which are so circumstanced as to appear to be of importance.)

Nelson Island, Jarvis Inlet.—Pinkish-grey granite. Takes a good polish, and has been used in the construction of the dry-dock at Esquimault. Well situated for quarrying.

North Arm of Burrard Inlet.—Grey granite, easily quarried in blocks of any size, at the water's edge, and used in construction at Vancouver.

Admiralty or Salt Spring Island.—Greenish-grey sandstone of excellent quality. Easily quarried and shipped. Used in construction of dry-dock at Esquimault.

Pender Island.—Sandstone of good quality quarried to a limited extent. Known as "Browning Island stone."

Newcastle Island, Nanaimo.—Sandstones quarried here has been used in the construction of the mint in San Francisco, etc. (See p. 107 R.)

Near Nanaimo.—Sandstones from an extension of the measures at Newcastle Island. Quarry opened in 1875.

Chase River Quarry, near Nanaimo.—Sandstones similar to those above noted.

Texada Island.—Grey, white and blotched marbles in unlimited quantity. These have been quarried to a small extent at Marble Cove on the north-east shore, three miles and a-half from the north point of the island. Useful for ordinary purposes of construction, and taking a good polish. (Report 1886, p. 34 B.)

Beaver Cove, north-east coast of Vancouver Island.—Half a mile up the stream, which enters at head of cove. Grey marbles, often handsomely variegated, have been quarried to a limited extent.

White Cliff Island.—(Between Chatham Sound and Grenville Channel.) Marble, white, grey and pinkish. Attempt made to open a quarry in 1878.

Marbles occur in many other places at which no work has occurred, on or near the coast of British Columbia. Among these may be mentioned:—

Nimkish Lake.—Grey and mottled marbles in great abundance.

Near Horne Lake, between Qualicum and Alberni.—According to Mr. J. Richardson, a great variety of ornamental marbles suitable for almost all purposes. (Report 1873-74, p. 101.)

The following eight localities are those noted in the course of a somewhat minute examination of the shores of the Strait of Georgia and Queen Charlotte Sound in 1885, as well adapted for the opening of quarries of building stone of good quality. None of them have yet been utilized:—

Near entrance to Squirrel Cove, Cortez Island.—(West side of entrance.) Pale greyish hornblende granite. (Report 1886, p. 23 B.)

Walsh Cove, Redonda Island.—Pinkish-grey granite. (Report 1886, p. 24 B.)

Bay on south side of Hardy Island, near Jarvis Inlet.—(West end of island) Granite. (Report 1886, p. 31 B.)

Otter Cove, Discovery Passage.—Pinkish granite. (Report 1886, p. 45 B.)

Small Island opposite Chatham Point, to the north.—Granite like the last. (Report 1886, p. 47 B.)

West shore of Port Harvey, Johnston Strait.—Grey granite, also in several other places in this vicinity. (Report 1886, p. 50 B.)

Haddington Island, Broughton Strait.—Grey calcareous sandstone. An extensive quarry might be opened here with facility. (Report 1886, p. 57 B.)

Ledge Point, Port McNeill.—Near the last locality. Sandstone, but

harder and less favourably circumstanced for working than the last. (Report 1886, p. 61 R.)

Of localities of building-stone in the interior of the Province it is possible only to mention a few in the immediate vicinity of the line of Railway:—

Near Cantilever Bridge, Fraser River.—Excellent grey granite quarried here, for use in construction of piers.

North Bend, Fraser River.—Similar granite quarried here, to a limited extent. This and the foregoing place may be taken as representing a large number of localities which might be utilized along this part of the Fraser.

South Side of Kamloops Lake.—Nearly opposite Tranquille, cliffs of tuffaceous sandstone and brown dolerite occur which might afford building-stone of fair quality.

South Thompson River.—(Seven miles below outlet of Little Shuswap Lake.) Granite of fair quality comes out on the line of railway. (Report 1877-78, p. 165 R.)

On the Shuswap Lakes abundance of moderately good building stones, (granites and other crystalline rocks) occur, and stones which may be used for construction are also found at intervals along the line of railway eastward.

Lime and Cement.

Of limestones suitable for making lime, it is possible merely to mention a few localities in which lime has been burnt, or which appear to be so situated as to be of immediate importance.

Victoria.—Several beds of limestone occur here in metamorphic rocks, and a little lime has been made from them from time to time, but the stone is too impure to afford a good lime.

Saanich.—Limestones affording excellent lime found in several places and burnt for use in Victoria.

Texada Island.—The northern part of the island, already mentioned as a locality of marble, affords abundance of excellent material for the manufacture of lime, and is readily accessible, (see p. 109 R.)

Near Agassiz Station, C.P.Ry.—Limestone occurs here. Of specimens of three varieties examined in the laboratory of the Survey, two proved sufficiently pure to make good lime. (Report 1888, p. 56 R.)

Near Popcum, Lower Fraser River.—Limestone, apparently of good quality, in a stream on north side of Cheam Mountain, situated about half a mile from the Fraser. Reported by Mr. A. Bowman.

Near Hope Station, C.P.Ry.—Limestone has been burnt here to a limited extent, at a place near Murphy's mine, about one mile above

Hope Station, and the same distance back from the railway. Lime has also been made about four miles above Hope, on the east side of the river, but was said to be impure.

About six miles above Yale.—Limestone or marble which has been burnt, but most of which is too siliceous to afford a good lime.

Near Forty-mile Post, Waggon Road, Fraser River.—Grey laminated limestone, about 100 feet thick and apparently of good quality. (Report 1877-78, p. 163 B.)

About seven miles above Spence's Bridge.—Limestone of good quality appears on the line of railway and also on the opposite side of the river, where it continues for several miles. (Report 1877-78, p. 163 B.)

North Thompson, six miles and a-half above Kamloops.—(East side of river.) Good limestone.

North Thompson, seventeen miles above Kamloops.—(West side of river, near Venn's.) Here and at several places a few miles further up, abundance of good limestone for burning.

South Thompson, ten miles above Kamloops.—(North bank.) Extensive exposures of good limestone. (Report, 1877-78, p. 80 B.) This and the two preceding localities are in communication by water with Kamloops, etc.

Shuswap Lakes.—Limestone suitable for burning in numerous places along the shores. (For details, see Report, 1877-78, p. 163 B.)

Quilchena, Nicola Lake.—(near mouth of McDonald River.) Good limestone, which has occasionally been used for the manufacture of small quantities of lime.

Near Stump Lake.—(a mile and a-half south from 'Palmer's,' on the hill.) Good limestone outcrops here, and may possess importance from its proximity to the Stump Lake mines.

For other occurrences of limestone in the southern interior of the Province, See Report, 1877-78. Limestones occur in great abundance and of good quality in that part of the Rocky Mountain range which is traversed by the railway. (Consult Reports, 1885. Part B., 1886, Part D.)

Near Skidgate, Queen Charlotte Islands.—Volcanic tuff resembling 'trass,' which may probably afford the basis of a hydraulic cement. (See p. 109 B.)

ORNAMENTAL AND PRECIOUS STONES.

The marbles included in the above enumeration, might be mentioned under the head of Ornamental Stones. For remarks on other materials see p. 108 B. Such localities as might be noticed under Precious Stones are mentioned on pp. 110 B, 111 B, and need not here be repeated.

MISCELLANEOUS MINERALS.

Arsenic.—Native arsenic in considerable mass in veins seven miles up Watson Creek, west side of Fraser River, 25 miles above Lytton. (Report, 1886, p. 86 T.)

Bismuth.—In long prismatic crystals of the sulphide, in quartz. Little Shuswap Lake, north side, a mile and three-quarters from head of lake. (Report 1877-78, p. 162 B.)

Iron-pyrites.—Specimen of massive pyrites, said to occur in large quantity, brought from Copper Island, Barclay Sound.

Plumbago.—Large deposit of disseminated plumbago at Alkow Harbour, Dean Canal.

Plumbago.—Specimens obtained by the Vancouver Island Exploring Expedition in the country north-east of Port San Juan.

Nickel.—Nickeliferous sand obtained in gold-washings on the Fraser River, consists of magnetite, and pyritous grains attracted by the magnet, which consist of oxides of iron and nickel. (J. Blake, M.D., Proc. Cal. Acad. Sci., V. p. 200.)

Asbestos.—Thibert Creek, Cassiar. Specimens of a rather coarse and brittle variety of serpentine-asbestos.

Asbestos.—Stewart River, Yukon district. Small specimen of good serpentine-asbestos obtained. (Report, 1887, p. 27 B.)

Mica.—At a place about 120 miles north-east of Clinton, a large deposit of mica is said to occur. Specimens of good size have been brought out, but having been obtained from the surface, are somewhat weathered.

Mica.—In large crystals in veins traversing granites near the extremity of the north-east arm of Shuswap Lake, and may prove to occur of useful dimensions here or elsewhere in the same mountain region. (Report, 1877-78, p. 162 B.)

Nitre.—Filling cavities in a cavernous calcareous tufa on the Nazco River. (Report, 1875-76, p. 265.)

Nitre.—Specimens received from Big Bar, Fraser River, where it probably occurs under circumstances similar to the last.

Bitumen.—Oozing out on the beach. Tar Islands, Queen Charlotte group. (Report, 1878-79, p. 60 B.)

Amber.—A rounded fragment found in possession of the Indians, and said to be derived from the west coast of the Queen Charlotte Islands. (Report, 1878-79, p. 85 B.)

MINERAL AND THERMAL SPRINGS.

Nanaimo.—Salt spring. Issues from the Cretaceous coal-bearing strata near the Douglas seam, and according to Mr. Richardson, has a flow of two to three gallons a minute. The Hudson Bay Company at one time attempted the manufacture of salt here, but it was soon abandoned. The brine has been analyzed by Mr. Hoffmann, who found it to contain 52.154 parts of saline matter in 1000. Of this thirty-nine parts were common salt and the remainder largely calcium chloride. According to an analysis quoted by Pemberton, it contained 49 parts of salt in 1000 in 1854. (Report 1872-73, p. 82. Facts and Figures relating to Vancouver Island, etc., p. 159.)

Admiralty Island.—Salt spring. According to analysis quoted by Pemberton in the place above cited, the spring contains 65 parts of saline matter to 1000, but with more impurities than the last.

Harrison Lake.—Hot springs, known as "St. Alice's Well." According to Dr. Selwyn there are two principal springs, with temperatures of 120° to 150° F. respectively, and both copious. The water has been analysed in the laboratory of the Survey and the results will appear in the annual report for 1838.

Near Lillooet River.—About five miles from head of Harrison Lake. Hot Spring, known as "St. Agnes' Well," no particulars.

Near Upper Columbia Lake.—Hot spring. At about two miles below the lower end of the lake, on a hill on the east side of the valley. Estimated to yield about twenty gallons a minute, at a temperature of 112° F. The outflow produces a calcareous deposit. A qualitative analysis has been made by Mr. E. B. Kenrick. (Reports 1885, p. 154 B., 1886, p. 15 T.)

Sinclair Pass.—Rocky Mountains. Hot springs, on south side of Berland's Brook, near the point at which it issues from the mountains into the Upper Columbia valley. Three springs reported, and said to be copious. Mr. John McKay, who discovered these springs, states the temperature of one as 108° F., of another as 118° F.

Elk River Valley.—Rocky Mountains, about Lat. 50° 7', warm sulphur-spring reported on east side of river by Mr. H. M. Hatfield.

Kootanie Lake.—Hot springs, giving its name to the "Hot Springs Mining Camp." Situated on west side of lake, directly opposite the "Blue Bell Claim." Several springs occur near the edge of the lake and some below the water-level. Temperature estimated at about 100° F.

Upper Arrow Lake.—Hot spring. On the east side of the lake, twelve miles from its head, and one hundred and fifty yards from the lake. Said to be about as hot as can comfortably be borne in bathing.

Albert Cañon Station C. P. Ry.—Hot spring. About a mile to the north of the Station. Temperature about the same as the last.

Near Upper Arrow Lake.—Hot spring reported by Indians at some distance back from the lake, on the flat land at the west side of the lake, three or four miles from its southern end.

Near Albert Cañon Station.—‘Soda spring.’ One mile and a half west of the station on south side of the track. This and the following springs are known as ‘soda springs’ in consequence of the presence of large quantities of carbonic acid gas.

Near Carne's Creek.—On west side of Columbia River and opposite the mouth of Carne's Creek. Group of springs with copious escape of carbonic acid gas.

Near Downie Creek.—‘Soda spring.’ Is situated about three-fourths of a mile north-west of the trail from Downie to Gold Creek and about four miles from the latter.

Four miles above Smith's Creek.—West side of Columbia River. Springs with considerable escape of carbonic acid gas, and deposition of iron-oxide, reported.

Skeena River.—Left bank, about fourteen miles above “Inverness Cannery.” Hot spring. No particulars.

Stikine River.—Hot spring. Situated a short distance above Buck's Bar and directly opposite the Great Glacier. No particulars.

Kennicott Lake.—At head of south branch of Taku River. Hot spring. Said to feed the lake. (Alaska and its Resources. Dall. p. 628.)

Hot Spring Island.—Queen Charlotte Islands. Hot springs with a slight smell of sulphureted hydrogen and a barely perceptible saline taste. Temperature over 100° F. (Report 1878-79 p. 22 B.)

Vermilion River.—Vermilion Pass, Rocky Mountains. About six miles west of the summit, on the north side of the valley, copious chalybeate springs, depositing ochre, from which the name of the pass is derived. (Report 1885, p. 120 B.)

Maiden Creek.—“Dougherty's spring.” South of Clinton, and about three miles up the stream from the waggon-road crossing. Mineral spring, highly charged with carbonic acid, which escapes in such large quantity as to prove fatal to small birds approaching the spring. A qualitative analysis by Mr. Kenrick. (Report 1886, p. 13 T.)

McDonald's 'Oil Spring.'—Head-waters of Omenica River, lat. 56°. This spring is marked as above on Trutch's map of British Columbia. It is not, however, an oil spring, but is described as a small mound in the centre of which a hollow exists charged with carbonic acid to such an extent as to prove fatal to birds and small mammals.

Spallumsheen Arm.—Shuswap Lake. A spring known to the Indians as Pilpilpoopil, issues near shore of lake. Gas or air escapes with the water in considerable quantity. (Report 1877-78, p. 25 B.)